

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE WEST VIRGINIA GEOLOGICAL SURVEY,  
I. C. WHITE, STATE GEOLOGIST.

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# SOIL SURVEY OF BARBOUR AND UPSHUR COUNTIES, WEST VIRGINIA.

BY

W. J. LATIMER.

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HUGH H. BENNETT, INSPECTOR, SOUTHERN DIVISION.

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[Advance Sheets—Field Operations of the Bureau of Soils, 1917.]



WASHINGTON:  
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1919.

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## LETTER OF TRANSMITTAL.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS,

*Washington, D. C., November 13, 1918.*

SIR: Under the cooperative agreement with the State of West Virginia a soil survey of Barbour and Upshur Counties was carried to completion during the field season of 1917.

I have the honor to transmit herewith the manuscript and map covering this work and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1917, as authorized by law.

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

HON. D. F. HOUSTON,  
*Secretary of Agriculture.*



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Soil map, Barbour and Upshur Counties sheet, West Virginia.



# SOIL SURVEY OF BARBOUR AND UPSHUR COUNTIES, WEST VIRGINIA.

By W. J. LATIMER.—Area Inspected by HUGH H. BENNETT.

## DESCRIPTION OF THE AREA.

Barbour and Upshur Counties lie in the north-central part of West Virginia, and comprise an area of 699 square miles, or 447,360 acres. Of this total 345 square miles is contributed by Barbour County and 354 square miles by Upshur County.

The area lies in the severely dissected portion of the Appalachian Plateau, and the general topography is hilly to mountainous. The ridges are comparatively narrow and frequently hogbacked, and the valleys are narrow and V shaped. The most prominent feature of the relief is Laurel Ridge, which extends along the eastern border of Barbour County.

The Buckhannon River, which flows north through Upshur County, broadens out into a wide valley below Buckhannon, and the Tygart River, which flows northwest to north through the center of Barbour County, forms a broad valley at Belington, but the upper courses of these streams lie in narrow valleys with steep walls in many places gorgelike. In the northern and western parts of Upshur County, with the exception of the Hackers Creek Valley, the topography is more subdued, as the hills are comparatively low and smooth and the valleys are fairly wide, with sluggish streams. Over the remainder of the county to the southeast the hills are comparatively steep, rough, and stony, and the stream valleys narrow, with little bottom land. The ridges and hills, however, are usually flattened. This sort of topography continues through the central part of Barbour County and to some extent eastward to the base of Laurel Ridge. The Hackers Creek region and that part of Barbour County lying west of the Tygart and Buckhannon Rivers have narrow, deep valleys and

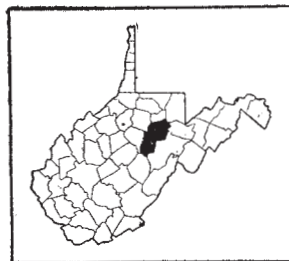


FIG. 1.—Sketch map showing location of the Barbour and Upshur Counties area, West Virginia.

"hogback" ridges, but the slopes are smooth. In the Meadowville-Kalamazoo section the hills are comparatively low and smooth and the streams have broad, flat bottoms.

The western slope of Laurel Ridge lies within Barbour County. Not only is this mountain much higher than the remainder of the area, but the country contiguous to its base is lower, so that the slope is both steep and long. This part of the county is rough and stony except in occasional oval-shaped patches on the face of the mountain. Broad terraces or former flood plains, fairly level, occur in the large bends of the Buckhannon River in the vicinity of Buckhannon and along the Tygart River at Belington and Philippi. Remnants of ancient terraces are found in many places between the headwaters of the present streams.

The general elevation of the hills and ridge tops along the western border of the area is 1,600 to 1,800 feet above sea level. The elevations gradually increase to the east and the ridge tops in the southeastern part of Upshur County rise to a maximum of 3,000 feet. Those in the eastern part of Barbour County along Laurel Ridge occasionally reach 3,250 feet. The stream level along the western border is 1,000 to 1,100 feet above sea level and 600 to 800 feet below the general elevation of the hilltops. Around Buckhannon the stream level is 1,400 to 1,500 feet and the hills rise only 300 to 400 feet above the streams. The streams in the southern part of Upshur County are about 1,800 to 2,000 feet above sea level and 700 to 1,000 feet below the near-by elevations. The Tygart River at the Taylor County line flows 1,000 feet above sea level and the surrounding hills rise to an elevation of 1,750 to 1,800 feet. The level of the Tygart River at Belington, in the southern part of Barbour County, is 1,600 feet, while the surrounding hills reach 2,000 feet and the mountains back of the latter 3,000 feet. These elevations show that the general slope of the ridge tops and smaller streams is northwest, with the dip of the rock stratification, while the larger streams flow northeast to north.

The main streams draining the area are the Tygart River, which flows in a general northerly direction across the middle of Barbour County, and its main tributary, the Buckhannon River, which flows in a general north to northeast direction through the center of Upshur County. The eastern side of Upshur County drains into the Middle Fork of the Tygart River and the southwest corner into the headwaters of the Little Kanawha River. A strip along the western side of Upshur County and practically the western half of Barbour County are drained into the West Fork and the Monongahela River through Hackers Creek, Elk Creek, and smaller streams.

Drainage ways reach almost every part of the area. Springs are not very numerous, and those that occur are usually small, but practi-

cally every farm is traversed by or lies near some stream. In dry weather many of the smaller streams go dry. The streams that flow from Laurel Ridge do not get as low in dry seasons as the other small streams. Imperfect drainage is practically confined to strips along some of the meandering streams of Upshur County, such as Brushy Fork, Fink Run, Pecks Run, and Turkey Run, and to the glade land around Meadowville and Danville in Barbour County. The streams that flow northwestward with the general stratigraphic dip of the country have the most fall and are actively cutting back into the drainage divides, encroaching upon the basins of the streams that flow northward. This process has resulted in the past in diverting many small drainage ways from their old channels and turning them into streams flowing west. Thus, in Barbour County, Charity Fork has been turned into Smiths Creek and Indian Fork into Elk Creek; in Upshur County Spruce Fork and Glady Fork have been turned into Stone Coal Creek, and the whole of the Little Kanawha drainage above Arlington has been diverted by that stream from its original course into French Creek. The Buckhannon and Tygart Rivers, which flow northward, have already reduced their bed to temporary base level, except for that part of the Tygart River where the course is northwestward. Here there is a much more rapid current than in the remainder of the larger streams. These sections of the Tygart River have rock beds and falls capable of developing water power, which is not used at the present time.

Barbour County was formed in 1843 and Upshur County in 1851. The first settlement was made about 1770, but it was not until about 1800 that permanent settlers came in large numbers, mainly from Virginia, Maryland, Pennsylvania, and New England. A large number came from Virginia and settled upon military-grant lands. During the early history of the county there was much confusion in regard to titles under land grants, and many settlers were forced to pay for their land several times. This discouraging situation resulted in many of the New Englanders moving to States farther west about 1830. The present population is largely descended from the original settlers. The negro population is small. Following the development of lumbering and coal mining many settlers came in from the southwestern part of Pennsylvania. A few foreigners, mostly Italians, are engaged in coal mining. According to the census, Barbour County in 1910 had a population of 15,858, or 45.6 persons to the square mile, and Upshur County a population of 16,629, or 47.4 persons to the square mile. Upshur County has increased in population about 62 per cent, and Barbour County about 34 per cent, since 1880. The northwestern part of Upshur County is the most thickly populated portion of the area, while Laurel Ridge and the southern and eastern part of Upshur County are the most sparsely settled. Over the north-

western half of the area, aside from the towns, the farming population is fairly well distributed, but elsewhere the country is thinly settled. The entire population is classed as rural.

Buckhannon, the county seat of Upshur County, is the largest town in the area. Including South Buckhannon, an adjoining incorporation, it had 3,106 population in 1910. Buckhannon is the center of a rich farming and grazing section and is a cattle-shipping point of some importance. It is also the center of a newly developing coal field. Philippi, the county seat of Barbour County, had a population in 1910 of 1,038. It is also the center of a rapidly developing coal field. Philippi is supported by a good grazing and farming country, and is a local shipping point for cattle. Belington, in the southern part of Barbour County, had 1,481 population in 1910. It is a railroad and mining center. Junior, 3 miles south of Belington; Century, in the southwestern part of Barbour County; and Berryburg, in the northwestern part, are small coal-mining towns. Frenchton, Adrian, and Alexander are small towns in Upshur County.

The inhabitants of Barbour and Upshur Counties are largely engaged in farming and stock raising. Recently developed coal fields employ large numbers of local and foreign operators. The oil and gas industry is not developed as in adjoining counties to the west. Although much of the land is under lease, little drilling has been done. Lumbering began about 1840, when logs were floated down the river to Pittsburgh and later to Grafton. About 1890, following the construction of railroads into the interior, lumbering became a very important industry in the southeastern part of the area. It is still of importance in the southern part of Upshur County, although most of the commercial timber has been cut.

Both counties have fairly good transportation facilities. The main line of the Baltimore & Ohio Railroad runs east and west a few miles over the line in Taylor County, and branches extend south to Philippi, Belington, Buckhannon, Sago, Alexander, and Century. The Western Maryland Railroad runs west from Elkins to Belington. The Coal & Coke Railroad, a part of the Baltimore and Ohio system, extends across the central part of Upshur County east and west, with a branch to Belington.

Some of the main roads in Barbour County and a few in the northwest corner of Upshur County are in good condition during dry seasons, but otherwise the main roads are only fair to poor. Practically all the secondary roads are very poor. About 80 miles of the main public roads in each county have been designated as Class A roads, for improvement by cooperation with the State and Federal Governments.



Buckhannon, Philippi, and Belington, together with the coal mining towns, furnish good local markets for farm products. Grafton, Clarksburg, and Fairmont are larger near-by markets. Pittsburgh, Washington, Baltimore, Philadelphia, and New York are the most important outside markets. Cattle are shipped mainly to Baltimore.

#### CLIMATE.

The climate of Upshur and Barbour Counties is temperate and healthful. The winters are cold but not as rigorous as those of the mountain section in the eastern part of the State. The summers are warm, but comparatively short. Hot spells are infrequent and last for only a short time. The nights during the summer, even in the hottest weather, are cool.

The mean temperature for the winter months, December, January, and February, according to the records of the Weather Bureau station at Buckhannon, is 32.1° F. A temperature as low as -34° F. has been recorded at Philippi, and -31° F. at Buckhannon. The temperature rarely sinks much below zero. The mean temperature for June, July, and August, as recorded at Buckhannon, is 69.7° F. The maximum recorded temperature is 99° at Buckhannon and 101° at Philippi. The mean annual temperature at Buckhannon is 51.6°.

The average annual precipitation of 49.14 inches is well distributed throughout the year. The heaviest rainfall occurs during the spring and summer, when most needed by crops and pastures. The spring and summer rainfall in the driest year on record amounted to 20.80 inches, which is only 7 inches under the average for these seasons. Autumn is the driest season, having a mean precipitation of 9.66 inches, but the rainfall is usually sufficient to keep the pastures green until frost. Floods usually occur in the early spring before planting time. The annual average snowfall is 49.7 inches, of which 31 inches falls during the three winter months. Snow does not usually remain upon the ground for long periods, and the winters are "open." The average date of the last killing frost in the spring is May 1 and that of the first in the fall October 6, giving an active growing season of approximately five months. Killing frost has occurred as late as June 11 and as early as September 21.

The climatic conditions in this region are favorable for general farming, stock raising, and orcharding.

The following table contains data taken from the records of the Weather Bureau station at Buckhannon. The elevation of this station is 1,433 feet above sea level. The climatic conditions at Buckhannon are practically the same as those recorded by the station at Philippi, in Barbour County.

*Normal monthly, seasonal, and annual temperature and precipitation at Buckhannon.*

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1895).	Total amount for the wettest year (1890).	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	32.9	70	-14	4.09	2.68	5.49	7.4
January.....	32.1	74	-25	4.35	4.14	5.26	11.4
February.....	31.1	77	-31	3.78	.91	6.16	12.2
Winter.....	32.1	77	-31	12.22	7.73	16.91	31.0
March.....	41.4	86	0	4.41	4.15	7.62	9.3
April.....	51.0	90	5	4.26	5.47	5.10	5.6
May.....	62.1	92	25	4.36	2.19	6.03	T.
Spring.....	51.5	92	0	13.03	11.81	18.75	14.9
June.....	68.8	96	34	4.92	2.55	8.28	0.0
July.....	70.2	99	42	5.33	3.67	3.06	0.0
August.....	70.0	96	40	3.98	2.77	3.79	0.0
Summer.....	69.7	99	34	14.23	8.99	15.13	0.0
September.....	64.6	95	29	3.05	2.05	5.63	0.0
October.....	53.1	88	16	3.22	1.94	8.59	T.
November.....	41.5	78	0	3.39	2.67	2.54	3.8
Fall.....	53.1	95	0	9.66	6.66	16.76	3.8
Year.....	51.6	99	-31	49.14	35.19	67.55	49.7

#### AGRICULTURE.

The first settlers in this region were hunters and trappers, who made only small clearings and planted corn as their principal food crop. They were soon supplanted by a class of settlers who made larger clearings and grew wheat and vegetables in addition to corn. Tobacco was introduced at an early date by settlers from Virginia, who grew it for their own use. Sheep and cattle were introduced about 1810. The sheep were kept for wool. The cattle were at first raised for milk, but later on, as the game supply began to diminish, for beef. Nearly all the early settlements were made in the larger stream bottoms. Extensive areas of virgin forests were cut down and the logs burned. After a few years of cultivation the land was generally put in pasture or allowed to grow up in brush, and new areas were cleared. The early production was scarcely sufficient to supply the new settlers and the continuous streams of emigrants that crossed this region on their way west. With the building of the Northwestern Virginia Turnpike (1840), passing near the northern border of Barbour County, and the Staunton and Parkersburg Turnpike (1845), passing through the northern part of Upshur County,



the demand for food products, live stock, and feed increased and farming was extended. Farther back from these roads, as in the central and southern part of Barbour County, where there was good grazing land, the farmers raised cattle and drove them across the mountains to eastern markets. The southern part of Upshur County remained undeveloped.

The construction, in 1864, of the Baltimore & Ohio Railroad, which passed near the northern end of the area, diverted travel and destroyed the ready market for subsistence products that had been enjoyed by the favored sections, but it brought the entire area into close touch with the markets of the East and gave a great impulse to cattle and sheep raising. Nearly all the good grazing land was cleared and put into pasture within the next two decades, and the growing of food crops was curtailed to the production of home needs. Cattle raising soon became the leading occupation and has remained so to the present time.

In general, crop production shows a steady increase during the last few decades, but the area in wheat declined from 12,542 acres in 1899 to 4,512 acres in 1909, and that in oats from 6,705 acres in 1889 to 2,879 acres in 1909. Potatoes show an increase of 37 per cent over the acreage in 1899. Buckwheat shows a marked increase during the last 30 years. It has gained more rapidly in Barbour County, while hay production has increased to a greater degree in Upshur than in Barbour County. Hay shows a slight increase in acreage and yield for each decade since 1880.

Agriculture in Barbour and Upshur Counties at the present time consists principally in the production of hay, corn, wheat, and buckwheat; the raising of cattle, sheep, horses, and hogs; and the fattening of beef cattle for market.

The table below shows the value of the different classes of crops and live-stock products for 1909:

*Value of crops and live-stock products for 1909.*

	Barbour County.	Upshur County.
	<i>Dollars.</i>	<i>Dollars.</i>
Cereals.....	304, 449	213, 523
Other grains and seeds.....	1, 434	1, 287
Hay and forage.....	181, 223	154, 828
Vegetables.....	123, 024	121, 825
Fruits and nuts.....	83, 200	46, 650
All other crops.....	62, 470	64, 757
Animals sold or slaughtered.....	588, 968	391, 744
Dairy products.....	85, 939	76, 755
Poultry and eggs.....	114, 035	89, 252
Wool and mohair.....	8, 081	10, 009
Total.....	1, 552, 823	1, 170, 630

The following table shows the acreage and production of the leading crops in 1909:

*Acreage and production of leading crops in 1909.*

Crop.	Barbour County.		Upshur County.	
	Acreage.	Production.	Acreage.	Production.
Hay.....	19,267	<i>Tons.</i> 18,943	17,436	<i>Tons.</i> 14,436
Corn.....	10,624	<i>Bushels.</i> 310,051	9,403	<i>Bushels.</i> 288,973
Wheat.....	3,243	35,282	1,269	12,724
Oats.....	1,351	21,862	1,528	22,737
Buckwheat.....	3,143	54,968	1,321	18,180
Potatoes.....	785	82,005	729	70,364

Hay and corn, the leading crops, are grown to be fed to horses, cattle, and hogs, and the sale of cattle is the main source of revenue. The horses are used for work stock, and the hogs are butchered for home use and to supply local markets. Potatoes are grown for home use and for sale. Apples, peaches, and other small fruits are grown for home use on most farms, and the surplus is sold on the local market. There are only a few commercial orchards in the area.

Clover, rye, millet, sweet potatoes, and sorghum occupy a small acreage on most farms. Soy beans, cowpeas, and alfalfa are gaining rapidly in popularity, but are still confined to small acreages. Tobacco is grown in small patches on a few farms. The vegetables common to this section are grown in gardens on nearly every farm.

Timothy is the leading grass used for hay. Of the 36,232 acres in tame grasses in 1909 timothy alone occupied 4,203 acres, timothy and clover mixed 16,359 acres, and all other tame grasses (excluding clover, alfalfa, and millet) 15,532 acres. This last classification includes mixtures of grasses in which timothy and redtop predominate. Wild marsh grass grows in profusion in the poorly drained bottom and glade lands and comes in persistently where tame grasses are seeded. If mowing land is allowed to run too long without reseeding weeds multiply abundantly, lowering the quality of the hay. Much of the hill land, especially in the northern two-thirds of the area, is in permanent pasture, largely bluegrass, but some of the pastures are seeded with mixtures. In the southern and eastern part of the area a grass known locally as "moonshine grass" is the dominant volunteer growth in pastures. While this is not as nutritious as bluegrass it furnishes fairly good grazing. Briers give considerable trouble in upland pastures and old mowing land. Bulrush and swamp grass are common in low places where water stands throughout most of the year.

The live-stock industry had reached an important development by 1880, when domestic animals represented the same proportion (13 per cent) of the total farm value as at present. In 1909 the value of live stock on farms was \$813,808 for Upshur County and \$1,068,837 for Barbour County. The number of cattle in 1909 was 12,520 in Upshur County and 16,583 in Barbour County. Dairy cows form about one-third the total number.

Most of the cattle are of improved breeds, and scrub stock is found only in the rougher sections and mountains. Pure-bred bulls are kept on a number of farms. Probably half the cattle are improved strains of beef breeds. About 70 per cent of the improved beef breeds are Hereford or Hereford grades. Shorthorn and Aberdeen-Angus make up the remainder. The improvement of breeds began with the introduction of the Shorthorn about 1885. The Hereford was introduced about 10 years later, and the Aberdeen-Angus about 15 years ago. The popularity of the Hereford cattle is due to their hardiness and adaptability to local conditions, and also to their quick maturity.

The building of silos and barns for winter housing has increased the efficiency of the cattle-raising industry fully 30 per cent during the last 10 years. There are a large number of silos at the present time, used mainly in supplying feed for wintering cattle and fattening them for market. Before the introduction of the silo most of the cattle were sold at 2 to 3 years, and cattle bought during the spring and summer were generally disposed of before winter, only enough animals being kept for breeding purposes. Even at present fully 75 per cent of the cattle are sold each season. The census reports 921 calves and 5,957 other cattle sold or slaughtered in Upshur County in 1909, and 956 calves and 9,287 other cattle sold or slaughtered in Barbour County. Most of the fattening for market is done by the larger farmers or cattlemen, who buy from the smaller farmer, without adequate means of wintering his stock, or from adjoining counties where the same conditions exist. Dairying is not developed to any large extent. Several small dairies furnish the local towns with milk. Most of the milch cows represent the few head kept on the average farms to supply milk and butter for home consumption or to meet the local demand for butter. Holstein, Jersey, and Shorthorn are the most common breeds of cows used for milk production.

Sheep have been kept in considerable numbers since the early days of settlement. About the same number are kept now as when sheep raising was at its height, but the industry is relatively unimportant owing to the large increase in cattle raising. The Merino was the first pure breed to be introduced. It was kept for the wool. About 1880 to 1890 the Merino was displaced by the Cotswold, Southdown, Shropshire, and Dorset, considered dual-purpose breeds.

Little care has been given the sheep during the last decade and the stock has become badly mixed. At the present time sheep are raised for mutton and for lambs. The number in Upshur County in 1909 was 16,957 and in Barbour 12,013. The number sold or slaughtered in Upshur County was about 6,800, and in Barbour County 5,500. About \$10,000 worth of wool was produced in Upshur County in that year, and \$8,000 worth in Barbour County.

Hogs are kept on nearly every farm. Berkshire, Chester White, Poland-China, and Jersey Reds are the leading breeds. The 1910 census reports 4,326 hogs in Upshur County on June 30 and 6,276 in Barbour County. A slightly larger number is sold or slaughtered each year.

Horses are raised on nearly every farm in sufficient numbers to supply the farm demand. About half the colts are of draft type and the rest standard-bred or saddle horses. There were 8,108 horses in both counties in 1909, and 122 mules.

Poultry is kept on nearly every farm to supply the home and local markets and afford an occasional surplus to ship to outside markets. The value of poultry of all kinds in 1910 was \$60,526.

The principal varieties of apples grown in the home orchards are the Rome Beauty, Ben Davis, Baldwin, Rambo, Northern Spy, York Imperial, russets of several kinds, Grimes, Red Astrachan, Delicious, and Winesap. These rank in importance in about the order named. The fruit is usually of good quality and excellent color, although little attention is given to the orchards. Peaches, pears, and plums also are found in home orchards. Raspberries grow wild in profusion, but are kept down in the grazing sections. The 1910 census reports 96,390 apple trees, 13,341 peach trees, and 3,407 grapevines in Barbour County; and 95,357 apple trees, 8,556 peach trees, and 3,584 grapevines in Upshur County. About 100 acres of cultivated bush berries are reported in both counties. Walnut, chestnut, and hickory trees grow in considerable numbers in the forest and are often left standing in fields and along fence rows.

There is a marked influence of soil character, topography, and physiography on agriculture in this area. Agricultural conditions are best over the northwestern corner of Upshur County and the western half of Barbour County, where the most desirable soils are found. The upland soils of this section comprise the best grazing land in the area, and support the greater part of the live-stock industry. The bottom land is best for hay and corn, and the terrace soils are well suited to general farming under improved methods. The farms of this section usually contain a strip of bottom and hill land, making a well-balanced tract. The topography here in general is smoother than that of the remainder of the area. The hills are more gently sloping and round topped, the bottoms are broader, and the terraces



are better developed. The Meadowville-Kalamazoo section of Barbour County is even more subdued.

Over the remainder of the area, with the exception of Laurel Ridge, the topography is more broken, with steep, rocky hillsides and narrow bottom lands, but the ridge tops are flattened and support fairly good farms. More cultivated crops are grown here than in other parts of the area. Much of the hillside land is devoted to pastures, but these are inferior to the bluegrass pastures of the grazing section. Large areas of woodland are found in this section. The steep grades and poor roads are a drawback to development, and the soil and topographic conditions are not favorable to the agricultural improvement found in other parts of the area. Laurel Ridge, stretching along the eastern side of Barbour County, is largely nonagricultural land, but some fairly smooth tract are found upon its face where farming and orcharding are engaged in.

Some farmers show considerable knowledge of the adaptation of the various crops to certain soils. The soil influenced by limestone (Westmoreland silty clay loam) is generally recognized to be the best grazing land. The low flat bottom land, "meadows," or "crawfish land" (Atkins silty clay loam), is used almost entirely for hay production. The better drained bottoms (Pope and Moshannon soils) are used to some extent for corn in recognition of their adaptation to that crop. The red upland (Upshur silty clay loam) is used for wheat, corn, and clover to a small extent. It is generally known that it is the best soil for these crops, but they are grown more extensively on the ridges in the eastern part of the area. The farmers on these ridges also grow considerable buckwheat, to which crop the ridge areas are well suited, both in soil and elevation. All the common crops are grown to some extent indiscriminately upon almost all the soil types.

Over the northwestern part of Upshur County and the western part of Barbour County, where the best farming conditions exist, the farm buildings are substantial and well kept and ample for the system of agriculture followed. Many silos are found in this section. Improved labor-saving machinery is used on most farms, such as mowers, reapers, hay rakes, hay tedders and loaders, grain and fertilizer drills, heavy draft plows, cultivators, and disk and spring-tooth harrows. Draft-type horses are used on many farms. In the southern and eastern part of the area, where the ground is rougher and stonier, the equipment in general is inferior, although on the best farms the implements do not differ greatly from those used in the more developed sections. Such implements as mowers, spring-tooth harrows, and grain and fertilizer drills are found on many farms, but much work is done with such implements as the cradle and hoe, seed is sown by hand, and single draft is used for plowing. Until a few years

ago the main dependence of this section was lumbering, and this still employs a considerable number of people, but much of the lumbering is done when the farm work is light.

Farming methods differ considerably in the two sections of the area. In the northwestern part, where cattle raising is the main industry, most of the hill land is in permanent bluegrass pasture, only a few patches of the more gently sloping areas or bench land being cultivated. The bottom land is used mainly for hay, but a small part of the higher bottom land may be in corn and a scattering of other crops. As a rule pasture land is not very often disturbed. The hay land in the bottoms is generally put in other crops at varying intervals. Often it is let run until filled with weeds. Hay is usually stacked in the field and fenced, and later removed as needed, but the better grade of hay is housed. Two cuttings are made in favorable seasons. The last, while not large, is usually of better grade, being comparatively free from weeds. Millet is sown if the hay crop is short. Sod land is usually broken to a depth of 6 or 8 inches in the hill areas and slightly deeper upon the terraces and bottom land. It is then gone over with a spike-tooth, spring-tooth, or disk harrow, depending upon the character of the ground, and fertilizer and seed are put in with the drill. Bluegrass is seeded to insure a good stand, even where it comes in naturally. Upon the terraces, where more cultivated crops are grown, land is not kept in sod so long before being plowed for wheat, oats, or corn. Potatoes are grown more extensively here. Intertillage is done largely with cultivators, and disk harrows are in more common use.

In the southeastern part of the area, although some cattle are raised and probably more sheep are kept than in other sections, general farming is better developed. The flattened ridge tops are devoted to wheat, buckwheat, oats, corn, and hay. The cultural methods are practically the same as over the remainder of the area, but fewer labor-saving implements are found here. Most of the plowing is done with light plows and hence is shallower. Subsequent cultivations are performed with plows and hand hoes. Cradles are used for cutting grain, but mowers are in general use for cutting hay and for keeping weeds down in the pastures.

In general, no regular or systematic form of rotation is practiced. The large area in pasture is mainly permanent, remaining in sod for 10 to 40 years. On the best farms of the terraces and bottoms the system followed results in a form of rotation. When timothy begins to fail and weeds come in to such an extent as to injure the hay, the sod is turned and planted to corn. Wheat, with timothy and clover, is sown on the corn stubble, the timothy and clover coming in after the wheat is cut. This usually is left for 3 to 7 years. Bluegrass is seeded with the other grasses when pasturage is desired.

In the southwestern part of the area the agriculture is more diversified. While much of the hillside land is in pasture, the flattened ridge tops are cultivated. When sod land is turned, corn is usually planted and wheat follows upon the corn stubble; but in place of grass being seeded with the wheat, buckwheat usually follows the wheat. This may be repeated several times before the ground is put back into grass. This form of rotation is not systematic, as it is not followed with regularity, and other crops such as oats or rye are grown at random.

Fertilizers have been used to some extent for the last 20 years, and at present they are in general use. The 1910 census reports the use of fertilizers upon 1,416 farms in Barbour County and 1,038 in Upshur County, or about half of all the farms. The expenditure in 1909 was about \$13.50 per farm. The most common forms of fertilizer used are phosphoric acid and bone meal. About 100 to 250 pounds per acre is used for corn, and 250 to 300 pounds for wheat, oats, or buckwheat. Liming is not in general practice over the entire area. In the eastern part of Barbour County most of the farmers use lime obtained by hauling lime rock from quarries on the eastern face of Laurel Ridge. This is burned in the field and applied at the rate of 25 to 50 bushels per acre at intervals of 4 to 6 years. In other parts of the area the lime used is mainly obtained from outside points. In a few scattered places over the western part of Barbour County and the Hackers Creek section lime is obtained locally from thin strata of limestone. Commercial lime is used in varying amounts, from 500 to 1,000 pounds per acre, and applied at irregular intervals. Lime is either broadcasted upon sod land after it is plowed, or upon corn stubble before seeding with wheat and grass. The small quantity of barnyard manure produced is usually applied to garden and corn patches. The stock is fed in the fields to a great extent and in this way most of the manure is returned to the soil.

Under the present system of farming little labor is required throughout most of the year. Additional labor is needed mostly at harvest time, in handling the hay crop, and in husking corn, and this can usually be obtained at reasonable prices in normal times. Ordinary wages during the last few years have been \$1 to \$1.50 a day. Most of the labor is hired on the day basis. At the present time wages are much higher, and it is almost impossible to obtain labor. Most of the farm work is done by the family except during the rush season, when help is obtained from the towns and from those engaged in lumbering and other industries. The farm laborers are practically all white and reared upon farms. In 1910, 54.8 per cent of the farms in Barbour County used hired labor, at an expense of \$70.20 each, and 47 per cent in Upshur County, at an expenditure of \$53.56 each.

The average size of farms in 1910 is given by the census as 99 acres in Barbour County and 87.8 acres in Upshur County. There has been a steady decrease in the average size since the beginning of agriculture. Only 10 farms in both counties have an extent of more than 1,000 acres.

In Upshur County 92.5 per cent of the farms are operated by owners, and in Barbour County 88 per cent. The farms operated by tenants are small and unimportant. In Barbour County, of the 213 farms operated by tenants 106 are rented on shares, 11 for cash and shares, and 96 for cash. In Upshur County 155 farms are rented, 33 on a share basis, 8 on a share-cash basis, 95 for cash, and 19 under a tenure not specified. The rent usually approximates 5 or 6 per cent of the value. The terms of the share tenants are usually arranged to suit the contracting parties and vary between wide limits. They usually provide for an equal division of the crops produced and of the increase in animals.

Of the total area of Barbour County in 1910, 90.1 per cent was in farms, of whose area 67.1 per cent was improved. In Upshur County 85.9 per cent was in farms and 64.5 per cent of the farm land was improved. The value of all farm property is given in the following table, taken from the 1910 census:

*Value of farm property in Barbour and Upshur Counties.*

County.	All prop- erty.	Land.	Buildings.	Implements.	Animals.	Number of farms.
	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	
Upshur.....	6,368,875	4,248,103	1,143,192	131,796	845,784	2,200
Barbour.....	7,238,951	4,809,229	1,162,750	159,779	1,107,193	2,026

Land values over the northwestern part of Upshur County and the western half of Barbour County range from \$60 to \$100 an acre, and over the north and south-central part of Upshur County and the eastern part of Barbour County, excepting Laurel Ridge, from \$20 to \$60 an acre. Agricultural land in the remainder of the area, including Laurel Ridge and the southern part of Upshur County, sells for \$10 to \$20 an acre. Cut-over land in these sections is valued at \$5 to \$10 an acre.

Many of the farms in the northwestern section, comprising a strip of bottom land and a somewhat larger area of hill land, are ideal for cattle raising and are held usually at high prices. Rent received from oil and gas companies and income from the sale of timber and coal have greatly increased the prosperity of the farmers, and this prosperity is evidenced by the general appearance of the farms. The population of the rapidly developing coal fields furnishes a constant demand for farm products that will further increase the prosperity of the farming class.



## SOILS.

Barbour and Upshur Counties lie within the Appalachian Plateau, which extends from Pennsylvania to Alabama and from Virginia on the east into Kentucky on the west. The soils are derived from the weathering of the underlying rock formations, of carboniferous and Devonian age, which are entirely sedimentary in origin.<sup>1</sup>

Geologically the rock strata lie as a great monocline, with a few minor anticlines and synclines. The strata over practically all of Upshur County and the western two-thirds of Barbour County dip gradually to the northwest, but so gradually that the formations locally seem to be horizontal. In the eastern third of Barbour County the strata dip gradually from the anticline to a line running north and south through Belington and Meadowville (the axis of the Belington syncline), then rise sharply eastward, the upper formation passing out and the lower ones forming Laurel Ridge. Dynamic disturbances, which have caused the folding of the rock strata, and the effects of erosion have brought to the surface the different formations which determine the character, topography, and distribution of the soils.

The following table gives the name, approximate thickness, and composition of the geological formations that outcrop and hence give rise to soils, as determined by the West Virginia Geological Survey:<sup>2</sup>

*Soil-forming rocks in Barbour and Upshur Counties.*

Age.	Formation.	Thick- ness.	Composition.
Carboniferous.....	Monongahela.....	<i>Feet.</i> 400	Alternating sandstone and gray and red shale, more or less calcareous.
	Conemaugh.....	600	Belts of red and gray shale predominating, sandstone, and thin limestone.
	Allegheny.....	250	Gray shale and sandstone (sandstone predominating).
	Pottsville.....	1,000	Gray shale and sandstone, hard coarse-grained sandstone, and conglomerate predominating near top.
	Mauch Chunk...	300	Red shale, green shale, red sandstone, and thin limestone (red shale predominating).
	Greenbrier.....	100	Limestone, red shale, and green sandstone (hard, blue limestone predominating).
Devonian.....	Pocono.....	500	Hard sandstone and conglomerate near top, gray shale at bottom.
	Catskill.....	600	Red sandstone, red shale, with gray and buff shales.
	Chemung.....	(?)	Olive-green and drab shales and thin sandstone.

<sup>1</sup> The geological data are based on reports of the West Virginia Geological Survey and the U. S. Geological Survey (Buckhannon Folio).

<sup>2</sup> The coal seams in the formation are omitted, as they have little bearing upon the soils derived from these formations.

The Monongahela and Conemaugh formations are found outcropping over the northwestern part of Upshur County and the western half of Barbour County. As the formations rise to the east the Monongahela, which caps the hills, soon disappears and the Conemaugh is found upon the hillsides and covering the crests. It caps the hills in a northeast and southwest belt through the center of the area and passes out entirely in the southern and eastern part of Upshur County. In Barbour County it dips again into the Belington syncline, where the formations reach stream level before rising and disappearing upon the caps of the low hills that skirt the base of Laurel Ridge. The upper 250 feet of the Monongahela formation is composed of thin alternating beds of sandstone and red and gray shale, and aided by gravity the surface material slips down the hillsides and becomes thoroughly mixed, the resultant soil extending farther down the hillsides than the horizon of the formation.

The remainder of the Monongahela formation and the Conemaugh is composed of fairly well defined belts where red shale predominates and others where gray shale and sandstone occur with the shale predominating. The shale formations are more or less calcareous.<sup>1</sup> The topography in these areas is hilly but comparatively smooth.

In the lower part of the Monongahela in Barbour County there are a number of thin-bedded limestone strata varying from 1 to 5 feet in thickness, which locally influence the soil. These formations thin toward the Upshur County line, and some of them disappear so that in this section their influence is not noticeable.

The Allegheny formation outcrops over the southern and eastern part of Upshur County and the central and southern part of Barbour County, and caps the highest areas along the Laurel Ridge. This formation is composed of alternate thin layers of sandstone and gray shale, the sandstone predominating. It forms a stony soil on the steep slopes and hillsides with a few areas comparatively free from stone upon the more nearly level ridge tops.

The upper part of the Pottsville formation consists of massive coarse-grained sandstones and conglomerates. The top formation (Homewood sandstone) is found outcropping along the river gorges, where it gives rise to rough stony land. This formation rises and caps the hills in the extreme southeast corner of Upshur County, supporting Mayer Ridge and Ash Camp Ridge and giving rise to a stony sandy soil. The lower portion of the formation, outcropping upon the lower slopes of the hills, is composed of sandstone and shale, similar to those of the Allegheny and giving rise to similar soil. The hard sandstone capping the Pottsville rises rapidly to

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<sup>1</sup> A number of tests were made in the field with hydrochloric acid upon the shales of the Monongahela and Conemaugh formations, and many were found to be calcareous.

the east in the eastern part of Barbour County, forming the western front of Laurel Ridge.

On the eastern face of Laurel Ridge, where the Barbour County line makes a detour from the cap of the ridge to take in the headwaters of Mill Run, different soil conditions are found. The underlying formations successively come to the surface. The Mauch Chunk, composed of red shale, and the Greenbrier limestone, consisting of a hard, blue limestone, outcrop well up on the mountain side. The red shale, being uppermost, covers the limestone so that little material from the latter enters into the composition of the soil. Below this the Pocono, a hard sandstone predominating, gives rise to hills covered with rough stony land. The lower part of the Pocono formation is composed of shales, which weather into a less stony soil. Very little of the Catskill formation, of Devonian age, is encountered in the area.

The soils of Barbour and Upshur Counties fall into three topographic groups: Upland or residual soils, stream-terrace (second-bottom) or old-alluvial soils, and first-bottom or recent-alluvial soils. The soils are classified into series, the members of which resemble each other in general characteristics, such as color, topography, drainage conditions, and mode of formation. The series are divided into types, the unit of soil mapping, the types of each series differing in texture, that is, in percentage of stone, gravel, sand, silt, and clay.

The upland soils are derived from the weathering of the underlying rock formations, which consist, as has been shown, mainly of strata of sandstone, gray and yellow shale, red calcareous shale, and limestone. On slopes material has accumulated in places by creep or by washing from higher positions. The Dekalb, Upshur, Meigs, and Westmoreland soils represent the upland series.

The Dekalb series is characterized by gray to yellowish-brown surface soils and yellow to yellowish-brown subsoils. It is derived from gray sandstone and gray, buff, and yellow shale. Five types of this series are mapped.

The Upshur series has brownish-red or Indian-red surface soils and subsoils. It is derived from more or less calcareous chocolate-red shale.

The soils of the Meigs series represent intermingled Upshur and Dekalb material. They are derived from alternate strata of gray sandstone and gray and red shale.

The Westmoreland series includes soils which resemble the Dekalb in physical characteristics, having brown soils and yellow subsoils, but which contain varying amounts of material derived from limestone along with material derived from shales and sandstones.

The old-alluvial or stream-terrace soils have been derived by wash from the drainage basins of the streams along which they occur. These terraces represent the former flood plains of the streams, which at present lie well above overflow. They are the result of local base levels, having been formed while the streams were engaged in cutting through hard sandstone strata, and in places such strata are found supporting the terrace. The difference in color between the terrace and first-bottom soils along the same streams is probably due to differences in the degree of weathering. The terrace soils in Barbour and Upshur Counties are classed in the Holston series, which is characterized by light-brown to yellowish-brown soils and yellow to yellowish-brown subsoils. They are derived from material washed very largely from sandstone and shale upland soils. The surface has been modified to some extent by erosion.

The recent-alluvial or first-bottom soils occupy the present flood plains of the streams, and are derived from wash from the local upland soils composed chiefly of sandstone and shale materials. The character of the deposits differs, as do also the drainage conditions, making four classifications necessary. The Moshannon, Pope, Atkins, and Huntington series are represented.

The Moshannon series represents the bottom land that has brown or reddish-brown soils and reddish-brown to chocolate-red subsoils. It is developed along streams that receive wash mainly from areas in which the Upshur soil predominates.

The Pope series is developed along streams that receive their wash almost entirely from Dekalb soils. It has brown to yellowish-brown soils and yellowish-brown to yellow subsoils, in places mottled in the lower part with gray.

The soils of the Huntington series are brown in the surface portion and brown to yellowish-brown in the subsoil. They are developed along streams where thin limestone strata outcrop over the drainage basin in sufficient extent to influence the soil.

The Atkins series is characterized by gray to grayish-brown, mottled soils, with mottled gray, yellowish-brown, and drab, plastic subsoils. The Atkins soils occur along streams that receive drainage from practically all the upland soils in the area. They differ from the other bottom-land soils in their poor drainage which is due to a heavier, more impervious subsoil.

Rough stony land includes steep, stony areas, mainly in forest and unsuited to agriculture.

The following table shows the physiographic position and the source of material of each soil type:

*Physiographic position and source of material of soil types.*

Group.	Origin.	Soil type.
Upland or residual soils.	Derived from sandstone and gray shale (sandstone predominating).	Dekalb stony loam.
	From sandstone and gray shale, coarse-grained sandstone predominating.	Dekalb stony sandy loam.
	From sandstone, gray and yellow shale, shale predominating.	Rough stony land. Dekalb silty clay loam.
	From medium-grained sandstone and shale.	Dekalb loam.
	From fine-grained sandstone and shale.....	Dekalb silt loam.
	From red shale (more or less calcareous).....	Upshur silty clay loam.
	From alternate layers of sandstone and gray and red shale.	Meigs clay loam.
Terrace or old-alluvial soils.	From sandstone, gray and yellow shale, and thin limestone.	Westmoreland silty clay loam.
	Wash mainly from shale and sandstone upland soils.	Holston silt loam.
	Wash from Upshur soils or strongly influenced by such wash.	Moshannon silt loam. Moshannon silty clay loam.
First-bottom or recent-alluvial soils.	Wash from Dekalb soils, shale predominating.	Pope silt loam.
	Wash from Dekalb soils, sandstone predominating.	Pope sandy loam.
	Wash from Westmoreland and Dekalb soils.	Huntington silt loam.
	Wash from practically all soils in the area, but subjected to poor drainage.	Atkins silty clay loam.

In the following pages of this report the various soil types are described in detail, and their relation to the agriculture of the area discussed. The map accompanying the report shows their distribution. The following table gives the actual and relative extent of each type:

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Dekalb stony loam.....	166,592	37.2	Pope sandy loam.....	7,872	1.8
Dekalb silty clay loam.....	131,456	29.4	Atkins silty clay loam.....	7,232	1.6
Rough stony land.....	36,416	8.1	Dekalb silt loam.....	4,160	0.9
Upshur silty clay loam.....	17,408	3.9	Holston silt loam.....	2,624	0.6
Westmoreland silty clay loam..	17,408	3.9	Huntington silt loam.....	2,176	0.5
Dekalb loam.....	16,896	3.8	Moshannon silty clay loam.....	1,344	0.3
Meigs clay loam.....	15,232	3.4	Moshannon silt loam.....	768	0.2
Dekalb stony sandy loam.....	11,904	2.6			
Pope silt loam.....	7,872	1.8	Total.....	447,360	.....



## DEKALB STONY SANDY LOAM.

The Dekalb stony sandy loam is a dark yellowish brown to grayish-brown, mellow sandy loam of medium to coarse texture, underlain at 6 to 8 inches by a subsoil of light yellowish brown to yellow sandy loam, slightly heavier and more compact than the soil. Scattered upon the surface and throughout the soil and subsoil are sandstone fragments and bowlders of varying size. These occur in such numbers as to make cultivation very difficult and in many places impossible. The bedrock from which the soil is derived is often encountered within less than 3 feet of the surface. This soil is very closely associated with Rough stony land, and in many places the boundary between the two types is not distinct.

The Dekalb stony sandy loam occupies steep hillsides and often extends over the ridge tops. It occurs in irregular areas in fairly well defined belts over the southeastern part of Upshur County, following the outcrop of the Pottsville conglomerate, from which it is derived. This formation consists of coarse-grained sandstone and conglomerate.

Possibly 85 per cent of this soil is covered by forest, which consists of chestnut, chestnut oak, white oak, poplar, and spruce pine or hemlock. Mountain laurel and rhododendron form a thick undergrowth in many places. The cleared area is almost exclusively in pasture. Moonshine grass makes a fairly good growth. Cultivation is confined to a few small patches of corn and garden vegetables. Corn yields are usually low, ranging from 10 to 20 bushels per acre.

The price of land of this type is low, ranging from \$5 to \$20 an acre.

In the less rocky and smoother areas the same methods of improvement can be followed as on the Dekalb stony loam. Much of the rougher land could best be left in forest, and the rest if cleared at all should be kept in pasture. The raising of goats would probably prove profitable. A few selected areas where the topography is not too steep could be used for orcharding.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Dekalb stony sandy loam:

*Mechanical analyses of Dekalb stony sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
221913.....	Soil.....	3.6	16.4	11.1	21.0	4.4	26.4	17.1
221914.....	Subsoil.....	2.1	14.0	10.9	20.1	4.6	30.0	18.1

## DEKALB STONY LOAM.

The Dekalb stony loam as typically developed consists of 6 to 10 inches of brown, yellowish-brown, or grayish-brown, mellow loam, underlain by a subsoil of yellow to yellowish-brown, friable silty clay loam to clay loam, becoming heavier with depth. Scattered over the surface and through the 3-foot section are quantities of sandstone and some shale fragments, besides boulders of various sizes. In nearly all places the amount of rock fragments is sufficient to interfere with cultivation. In many cases most of the fragments are on the surface, and many fields have been cleared by placing them in piles in the field.

The texture of the soil varies considerably. Along the margin where the type comes in contact with the Dekalb silty clay loam it grades to a stony silty clay loam, while along the outcrop of sandstone formations it contains a considerable percentage of sand and in some cases is a stony sandy loam. Other areas, usually more extensive than either of the foregoing, consist of stony silt loam. These areas are all too small or too irregular in occurrence to separate.

The Dekalb stony loam is derived largely from the alternating sandstone and gray shale strata of the Allegheny formation. These strata are comparatively thin and where they occur upon the hillsides they become well mixed, forming a type that on the whole is fairly homogeneous. Where the sandstone predominates the soil contains more sandstone fragments; where the shale areas abound rock fragments are less numerous and this soil is more valuable from an agricultural standpoint. The value of the type, however, depends more upon the character of the surface and the steepness of the slope than upon the texture.

The main body of the Dekalb stony loam occupies steep hillsides and mountain ridges. In some places in the northern part of Upshur County it is found capping ridges or hills. The run-off is rapid, and crops often suffer for want of moisture during dry seasons. Erosion is usually active in the cultivated fields.

A large area of this type still remains in forest. Most of it is cut-over land. The principal tree growth is chestnut, chestnut oak, white oak, beech, and poplar. Cultivation is restricted by the steepness of the slopes and the stoniness of the surface. In the southern part of Upshur County only a small percentage of the type has been cleared and most of this is devoted to pasture. The so-called moonshine grass furnishes fairly good grazing for a few cattle and sheep. Corn is the principal crop. Some wheat, oats, and buckwheat are grown, and a little hay. Grain usually must be sown and harvested by hand, as improved farm machinery can not be used to advantage.

The farms consequently are poorly equipped, and the returns small. Corn yields 10 to 25 bushels per acre. Little fertilizer or manure is used. One large commercial apple orchard is located upon this soil on the slope of Laurel Ridge east of Belington.

The larger part of this soil is best suited for use as pasture, and should be confined to this use, as there is usually ample land upon the ridge tops suitable for cultivation. The more gently sloping and cove positions, however, can be safely cultivated. Apples of standard varieties could be grown in the more favorable locations, but most of the type is too steep for profitable commercial orcharding. Grapes would succeed, and could be grown even in the steeper areas. Burley tobacco is grown profitably upon this soil in other sections of West Virginia. Sheep raising should be a successful undertaking on this land.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Dekalb stony loam:

*Mechanical analyses of Dekalb stony loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
221909.....	Soil.....	3.4	4.9	4.0	20.9	13.0	37.8	16.1
221910.....	Subsoil.....	1.8	5.7	4.0	18.0	11.0	39.2	20.1

DEKALB LOAM.

The soil of the Dekalb loam is a grayish-brown or dark-brown, mellow loam in the surface few inches, passing below into yellowish-brown, mellow loam. The subsoil is encountered at 6 to 10 inches, and consists of yellowish-brown to yellow or pale-yellow silt loam to silty clay loam, slightly compact though friable. In places the surface few inches is dark brown, and again the immediate surface may be yellowish brown. Locally the soil contains considerable sand, mainly of medium and fine texture but coarse in a few places in the southeastern part of Upshur County, where the coarse-grained sandstone strata lie close to the surface. The soil often rests upon a bed of sandstone within 2 to 5 feet of the surface. Fragments of sandstone are scattered upon the surface and throughout the soil and subsoil in many places, but not in sufficient quantity to interfere seriously with cultivation. In the southern part of Upshur County the surface soil of some of the ridge-top areas is ashy gray.

The Dekalb loam is derived from sandstone strata mingled with the residue from the overlying shale formation. A thick sandstone stratum closely underlies this soil, resting in an almost horizontal position or dipping slightly.



Areas of Dekalb loam are scattered over the southeastern part of Upshur County and the south-central part of Barbour County. The largest single development is along the broad, flat ridge tops north of Tygart River between Belington and Philippi. The type is associated with the Dekalb stony loam, stony sandy loam, and Rough stony land. The topography in most cases is fairly level to gently rolling or gently sloping, and the run-off, although sufficient to insure thorough drainage, is not rapid enough to do much damage through erosion. The 30 or 40 per cent of this soil still in forest is mainly in the southern part of Upshur County. Most of this is cut-over land. The remaining trees are largely oak, chestnut, and poplar, with a scattering of other hardwood trees.

The Dekalb loam is naturally not a very fertile soil, as is indicated by its light color and low organic content. Its texture, however, makes it responsive to good farming methods, and it is capable of being brought to a satisfactory state of productiveness. Only small quantities of commercial fertilizer or manure are used. The isolated position of much of the type is a serious drawback to its agricultural development, but in many of the rough, hilly sections it is one of the few desirable soil types, or even the only soil on which mowing machines or reapers and binders can be successfully used.

The principal crops grown are wheat, corn, buckwheat, oats, and hay. Some of the type is in pasture, but bluegrass does not hold well and moonshine grass, which flourishes in the hill section, does little better. Crops may suffer from lack of moisture during the extreme dry seasons, owing to the high, exposed position and the shallow depth to bedrock, but the droughtiness is less pronounced where the sandstone is massive and coarse grained and acts as a reservoir for moisture. Corn yields 12 to 35 bushels per acre, with an average of about 25 bushels. Oats yield 20 to 25 bushels in good seasons. Wheat yields only 10 to 12 bushels, unless highly fertilized, in which case it runs 15 to 18 bushels. Hay cuts one-half to 1 ton per acre. All the common fruits seem to thrive, especially apples, but fruit is produced only in home orchards.

The price of land of the Dekalb loam depends to some extent upon the location with reference to transportation facilities. It ranges from \$15 or \$25 an acre in the rougher sections to \$35 or \$50 an acre in the more developed sections.

To improve this soil the organic content must be built up by turning under sod or manure and by growing legumes. Liming and the application of commercial fertilizer are followed by good results. The applications of lime could be much lighter than upon the heavier soils, but fertilizer should be used in heavy applications unless manure can be obtained. Four or five hundred pounds per

acre of a good complete fertilizer could probably be applied to all intertilled crops with profit. Acid phosphate or bone meal can be used profitably for wheat, oats, and buckwheat. Where it is difficult to secure a good stand of clover, as is sometimes the case, cowpeas, soy beans, vetch, and melilotus should be substituted, as these crops can be successfully grown. In areas within reasonable distance of transportation lines vegetables, especially Irish potatoes, could be grown for market.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Dekalb loam:

*Mechanical analyses of Dekalb loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
221925.....	Soil.....	0.5	3.2	4.9	17.6	7.0	50.1	16.7
221926.....	Subsoil.....	.4	3.0	5.4	16.9	6.2	47.0	21.0

DEKALB SILT LOAM.

The soil of the Dekalb silt loam consists of a gray to grayish-brown, mellow silt loam passing within a few inches into a yellowish-brown or pale-yellow, slightly more compact but friable silt loam. At 6 to 8 inches the subsoil is encountered, consisting of a yellowish-brown to yellow silty clay loam to silty clay, compact but friable in structure. The soil is usually deeply weathered, but contains a few fragments of shale and sandstone. The parent rock is rarely encountered within 3 feet of the surface.

Small areas of Dekalb silt loam occur in nearly all parts of Upshur and Barbour Counties, the largest areas being found in what is known as the "Flatwoods" section southwest of Philippi. It has a fairly level topography, occupying comparatively flat ridge tops or shelf positions. Drainage is well established, but the soil suffers very little from erosion. This type is known locally as "chestnut land," from the abundance of this tree. Most of the land is cleared and either in cultivation or used for pasture. Besides chestnut the native tree growth includes oak and chestnut oak, with a scattering of other hardwood trees. Grass does not succeed so well as on the Dekalb silty clay loam, and a correspondingly larger area is given to cultivated crops, not many cattle or sheep being raised. Bluegrass does not come in very strong, and broom sedge and moonshine grass are apt to dominate in the pastures. Corn, wheat, oats, buckwheat, and cowpeas occupy relatively larger acreages than upon the other upland soils. Irish potatoes and various garden vegetables are grown on all farms. The orchards on this soil are in splendid condition.

Although small they contain a variety of fruits, chiefly apples, cherries, peaches, pears, and plums. Of these apples are the most important.

This soil does not produce quite as well as the Dekalb silty clay loam, but gives fair returns when highly fertilized or manured. Cowpeas give good yields and seem to do uniformly better than clover. Irish potatoes yield from 150 to 250 bushels per acre and buckwheat 20 to 25 bushels. These two crops probably do as well as upon any of the soils. Wheat yields 10 to 20 bushels per acre, and oats 15 to 25 bushels. Hay usually runs three-fourths to 1 ton per acre. Corn yields 20 to 45 bushels per acre.

The Dekalb silt loam is much easier cultivated than the Dekalb silty clay loam, and it forms a mellow seed bed where properly handled, but in dry weather it has a tendency to become droughty and crops may suffer from lack of moisture during prolonged droughts. Liming is done by a few farmers. Acid phosphate is used, in small amounts by some farmers and liberally by others.

The price of land of the Dekalb silt loam ranges from \$20 to \$60 an acre.

This soil is deficient in organic matter, and cultivated crops should be grown in rotation with grass or other cover crops. Lime used at the rate of 600 to 1,000 pounds per acre gives good results. Fertilizers are said to be profitable for nearly all crops. Phosphatic fertilizers seem to be especially beneficial, as is also manure. Such legumes as cowpeas, soy beans, and vetch should be grown, especially where clover will not catch. Where hay is grown a mixture of grasses can be sown to advantage, such as timothy, redtop, orchard grass, and bluegrass. Reseeding every second or third year may be necessary, as grass tends to fail if let run for a longer period. Bluegrass should be seeded with a nurse crop and allowed to run until the grass begins to fail, when the sod should be plowed and reseeded.

This type is well suited to apples, and it contains many good orchard sites. Bright Burley tobacco is grown successfully in other counties of the State. This is also a very good Irish-potato soil, and this crop should prove profitable where the fields are within reasonable distance of transportation lines.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Dekalb silt loam:

*Mechanical analyses of Dekalb silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
221911, 221919.....	Soil.....	0.2	1.8	3.2	5.9	8.2	60.3	20.1
221912, 221920.....	Subsoil.....	.2	2.1	3.4	5.8	9.7	56.5	21.7

## DEKALB SILTY CLAY LOAM.

The Dekalb silty clay loam, as typically developed, is a yellowish-brown or light-brown silt loam passing at 1 to 4 inches into a silty clay loam. The surface soil averages 5 or 6 inches deep and is underlain by a subsurface layer of yellow or brownish-yellow, more compact silty clay loam. This grades at 8 to 10 inches into the subsoil proper, which is a yellow or orange-yellow silty clay. The subsoil when dry is fairly compact or stiff. Shale fragments are present, especially in the lower subsoil, and on some of the steeper slopes, particularly, decomposed bed shale is encountered within the 3-foot section.

Included with this type are many patchy areas of soils which do not conform with the typical Dekalb silty clay loam. There are three principal variations.<sup>1</sup> In areas north and west of Buckhannon the surface soil averages somewhat browner than typical, and the subsoil, the lower subsoil in particular, has a light-reddish cast, being light reddish brown or reddish yellow. The reddish color is apparently due to material derived from red shale. This soil represents an approach toward the Upshur silty clay loam or an intermediate soil, in point of color, between the Dekalb and the Upshur silty clay loams. It seems a little more productive than the Dekalb silty clay loam. Grass and corn do very well, but there is not as much bluegrass as is generally seen upon the Upshur soils.

Another included soil which is less extensive than the variation just described occurs in the vicinity of Hodgeville. It consists of yellowish-brown to light-brown silty clay loam or silt loam passing quickly into a subsurface silty clay loam which is yellow or light yellowish brown. This is underlain at 8 to 10 inches by yellow or orange-yellow silty clay which passes in the lower part of the 3-foot section into brownish-red or mottled brownish-red and yellowish, plastic clay. The upper subsoil is fairly compact when dry.

The third variation consists of a grayish-brown silty loam quickly passing into a yellowish-brown silty clay loam, and this at 3 to 5 inches into a yellow, slightly compact silty clay loam. This grades at 8 to 10 inches into a subsoil of pale-yellow or yellow silty clay, underlain by mottled grayish and yellowish, plastic clay or bluish-gray, plastic clay mottled somewhat with yellow or yellowish brown. This soil is derived from heavy clay shale, the same shale that gives rise to the beds of fire clay encountered in the area. These beds are usually thin, ranging from a few inches to a few feet. Where this material forms the subsoil it is impervious.

<sup>1</sup> These soils would be mapped as distinct types of new series if developed in sufficiently large areas to map. They occur where the Dekalb type is found upon the slopes below the Meigs or Upshur soils, or where thin strata of red shale outcrop in an otherwise extensive area of yellow shale. Away from the influence of the red shale the Dekalb silty clay loam has a grayer surface soil and a yellower subsoil than elsewhere.



Some of the shale strata giving rise to the Dekalb silty clay loam are slightly calcareous, influencing the soil to a small degree. This seems to be one of the main differences, aside from texture, between this soil and the Dekalb silt loam.

The Dekalb silty clay loam is the second most extensive and widely distributed soil in the area. It occupies much of the hillsides over the northwestern part of Upshur County and the western and west-central part of Barbour County, and caps the hills through the southwestern, central, and northeastern parts of Upshur County and the southern, central, and northern parts of Barbour County.

The topography is gently rolling to hilly and steep, but the hillsides are fairly smooth. Although the run-off is rapid, the type does not suffer so much from erosion, even on the steeper slopes, as might be expected.

Probably 20 or 30 per cent of this soil consists of cut-over land, with white oak, red oak, chestnut oak, hickory, walnut, chestnut, ash, beech, maple, poplar, and locust as the principal tree growth. Probably 85 per cent of the cleared land is in permanent pasture, and the remainder is cultivated. Most of the cultivated areas are favorably located areas on benches, gently sloping hillsides, or the smoother ridge tops. Where the steeper slopes are in corn the land is usually being changed from old sod to new. Corn and hay are the principal crops. In the eastern part of the area more wheat, buckwheat, and clover are grown. Cowpeas, millet, sorghum, rye, and Irish potatoes are minor crops. There are on this soil small thrifty orchards, including nearly all the varieties of apples grown in this section. Cherries, peaches, pears, and plums are produced in smaller quantities, and these trees also are healthy and vigorous. Enough fruit is produced on nearly every farm to supply home needs, and there is often a surplus for sale. The common vegetables are grown in gardens. Irish potatoes usually occupy an acreage equivalent to that of all the other garden crops. Potatoes are grown in sufficient quantities to supply the local markets. This soil furnishes good grazing even on the steeper slopes, but there seem to be more weeds and wild grasses and less bluegrass than on the Upshur, Meigs, or Westmoreland soils. A large number of cattle are grazed; and a few horses, sheep, and hogs are kept on nearly every farm.

Yields upon this soil vary between wide limits, owing to the difference in the efficiency of farming methods. Where some system has been followed by which the soil is built up the yields are invariably good. Corn yields 15 to 45 bushels per acre, wheat 15 to 25 bushels, oats 20 to 30 bushels, buckwheat 20 to 35 bushels, and potatoes 100 to 250 bushels. Timothy hay yields an average of 1 ton per acre in ordinary seasons. Wheat or buckwheat is rarely grown without fertilizers applied at the rate of 250 to 300 pounds per acre.

Acid phosphate or bone meal are the substances commonly employed. These are used by some farmers also for corn. Liming is not general, except in neighborhoods where limestone rock is available within reasonable haul. In such cases it is burned in kilns located in or near the field.

Land of this type of soil varies considerably in price according to the location, ranging from \$30 in more remote sections to \$100 an acre in sections better developed.

The Dekalb silty clay loam is generally deficient in organic matter. It clods more than the silt loam and loam types, and the preparation of the seed bed is more difficult. It could be improved by turning under a sod every three or four years and applying 1,000 to 2,000 pounds of burnt lime per acre or its equivalent of crushed limestone. Clover, cowpeas, soy beans, and vetch should be grown more frequently in the rotation. Heavier and more general applications of phosphatic fertilizer probably would be profitable for all crops. This soil is well adapted to the production of Irish potatoes, which are an important crop on it in some other counties of the State. Where clover does not thrive soy beans and cowpeas make good hay crops. These plants, like clover, add nitrogen to the soil. Apples do well on this soil, and, the climatic conditions being favorable, commercial orcharding would seem to be one of the possible uses of the type.

#### UPSHUR SILTY CLAY LOAM.

The Upshur silty clay loam is a brownish-red or reddish-brown silty clay loam underlain at 6 to 8 inches by brownish-red, rather stiff clay. In places the surface soil is only slightly reddish either on account of overwash or admixture of material from lighter colored soils above or owing to the lighter red color of the parent rock. In other places the surface soil and subsoil are dark brownish red or dark chocolate. The red color of the soil is due to the red color of the parent rock. In many cases shale fragments occur on the surface and in places partly decomposed shale is encountered within the 3-foot section, but as a rule the weathering is deep. The occurrence of shale fragments near the surface is generally confined to situations where erosion has removed the surface soil. Upon hill-sides where yellow shale outcrops above, partially decomposed fragments are found in the subsoil which give an appearance of yellow mottling.

A characteristic feature of this soil is that it is friable or brittle when dry and plastic and sticky when wet. In places where the soil has been wholly or partially removed by erosion, exposing the clay subsoil, the surface bakes and cracks deeply upon drying, and this tendency seems characteristic of the typical surface soil itself where

the organic content has been depleted. Spots of Upshur clay are included which differ only in having a shallow silty clay loam or clay loam surface soil, underlain by the typical clay.

The Upshur silty clay loam occurs in fairly well defined belts over the northwestern part of the area, northwest of a line through Rock Cave, Buckhannon, and Philippi. It also occurs in scattered areas between Belington and Dent in Barbour County. A small area is mapped on the east side of Laurel Ridge around the headwaters of Mill Run, where the type is derived from the Mauch Chunk shale and the Greenbrier limestone, and, as in Preston County, where this soil is derived from the same formations, the red shale of the upper formation has completely covered the limestone so that the resultant soil is influenced by the limestone to only a small extent.

The Upshur silty clay loam occurs in very narrow strips winding around the hillsides at definite elevations and occupying definite positions with reference to the rock stratification. The topography varies between steep to gently sloping hillsides, more nearly level benches, and rounded hilltops. The surface is fairly smooth, but broken in some places by gullies. The slope is sufficient in all cases to insure good drainage, but the supply of moisture retained is greater than in the lighter soils.

The Upshur silty clay loam is derived from the weathering in place of more or less calcareous<sup>1</sup> red shale strata which vary in thickness but outcrop at nearly equal elevations through the area. The formations thin toward the north and the areas are not so large in Barbour as in Upshur County.

The timber growth, which is confined to a few woodlots, consists mainly of oak with a scattering of maple, ash, poplar, chestnut, locust, and ironwood. There are a few scattered hickory and walnut trees which were left when the land was cleared.

This is recognized as one of the strongest upland soils of the area. About 90 per cent of it is cleared and either under cultivation or used for hay production or permanent pasture. Nearly 60 to 70 per cent of the area farmed is in permanent pasture; the rest is devoted mainly to corn, timothy, and clover, with wheat, oats, buckwheat, and cowpeas occupying relatively small areas. Many beef cattle are grazed, this soil supporting a larger number per acre than any other soil in the two counties, with the exception of the Westmoreland silty clay loam. A small number of sheep and a few horses also are pastured.

The Upshur silty clay loam usually supports an excellent bluegrass sod, with little broom sedge or other grasses or weeds. The sod usually remains good during dry seasons, and lasts for an in-

<sup>1</sup> Most of the shale formations from which the Upshur is derived effervesce with hydrochloric acid, but although lime nodules are found in places no trace of lime in the form of carbonate is present in the surface soil.



definite number of years. Notwithstanding the fact that bluegrass comes in naturally, it is usually seeded to insure a good stand. For hay, timothy is usually seeded alone, but timothy and clover are often seeded together and clover alone is more popular than on the other soil types, as it does uniformly better. The yield of hay ranges from 1 to  $1\frac{1}{2}$  tons per acre, rarely falling below 1 ton even in dry seasons. Buckwheat, which is grown to a small extent, is not so well suited to this soil as to the Dekalb types, but it yields 18 to 20 bushels per acre. Corn gives better yields than upon the other upland soils, but it requires considerably more care on account of the heavy nature of the soil, and this probably accounts for the small acreage. The yield ranges from 25 to 60 bushels per acre, with an average of about 40 bushels. Wheat and oats do better than upon any other upland soil, wheat yielding 12 to 30 bushels and oats 25 to 45 bushels per acre. Farmers on this soil prefer to graze it rather than put it in crops that require tillage, and cultivated crops are grown only when there is a rotation followed in which the old sod is broken and a new one desired. Fruits do only fairly well. The trees do not seem to thrive as upon some of the lighter soils, hence the type is not used for fruit extensively. It is not so well adapted to vegetables as the other lighter soils.

In preparing a seed bed upon this soil the sod land is plowed deep in late winter or early spring, so as to subject the soil to alternate freezing and thawing. The main reason for this practice is the tendency of this soil to remain wet and cold late in the spring. The land is disked or harrowed thoroughly before seeding. The heavy intractable nature of this soil makes cultivation difficult, and unless the seed bed is thoroughly prepared the chances of obtaining a good crop are lessened. Care must be exercised not to plow the soil when it is wet, as clodding results.

Acid phosphate and bone meal are about the only fertilizers used. For corn 250 to 300 pounds per acre is usually applied, together with the barnyard manure available. For wheat, oats, timothy, clover, or grass 500 pounds of lime or 250 to 300 pounds of bone meal or phosphate is frequently applied per acre.

This land is highly valued for farming, and is held at prices ranging from \$40 to \$100 an acre.

This soil is naturally durable and productive. Where sod is turned under at intervals of 3 or 4 years and 500 to 1,000 pounds of lime is applied per acre, with 250 to 500 pounds of phosphate or bone meal preceding a grain crop, good yields are obtained. Lime is not as essential as upon the Meigs or Dekalb soils, but good results follow its moderate use. The greatest need of the soil is the incorporation of organic matter in large quantities to improve the structure. Under the present system of farming extensive manuring is not possible, but



the growing of legumes, such as clover, cowpeas, vetch, soy beans, and melilotus, would help materially to improve the soil. Where sod begins to fail the application of bone meal, ground limestone, or manure usually rejuvenates the grass, but when such treatment proves of no avail, the field should be reseeded. This, however, is seldom necessary.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Upshur silty clay loam:

*Mechanical analyses of Upshur silty clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
221903.....	Soil.....	1.1	0.9	0.5	6.0	10.4	56.1	25.2
221904.....	Subsoil.....	.7	2.2	1.2	6.8	6.8	50.1	32.1

#### MEIGS CLAY LOAM.

The Meigs clay loam consists of undifferentiated areas of Dekalb and Upshur soils, chiefly silty clay loam and clay loam along with mixed Upshur-Dekalb material. The soil also includes Upshur clay and Dekalb silt loam. In patches these different soils are encountered in typical developments, but over much of the type, especially on the steep hillsides, they have slipped down and become thoroughly mixed.

The Upshur clay has a very shallow surface soil of chocolate-red or Indian-red clay to clay loam and a subsoil of heavy, compact, red to Indian-red clay which is friable when dry and plastic when wet. The Upshur silty clay loam consists of a reddish-brown silt loam to silty clay loam, 6 to 8 inches deep, underlain by red clay similar to the subsoil of the Upshur clay. The Dekalb silty clay loam has a yellowish-brown silt loam to silty clay loam surface soil, 6 to 8 inches deep, underlain by yellowish-brown to yellow silty clay loam to silty clay. The included Dekalb silt loam is very similar except for the surface 6 to 10 inches of silt loam material.<sup>1</sup>

In some sections in the western part of Barbour County thin strata of limestone outcrop and locally influence the soil. In scattered areas, usually near the crest of ridges and upon high points, patches of Dekalb stony loam are found associated with the Meigs clay loam, but are too small to separate.

A characteristic of the Meigs clay loam is the large quantity of partially decomposed shale and sandstone fragments encountered throughout the soil and subsoil. The parent-rock material is often encountered within the 3-foot section.

<sup>1</sup> The principal soil types comprising the Meigs clay loam are described more fully under their respective heads.

The Meigs clay loam is derived from thin beds of red and gray shale and gray sandstone, which occur in alternate layers. The topography is usually steep, which results in considerable mixture of the weathered soil material by sliding.

The Meigs clay loam is developed over the northwestern part of the area above a line extending through Atlas, Hodgeville, Elk City, and Berryburg. The type is usually found upon the hilltops but extends well down the hillsides in places, as along Smiths Creek and the Right Branch of Gnatty Creek. In many places the boundary between this soil and the Upshur silty clay loam or Westmoreland silty clay loam can be traced by the tree line, the Meigs clay loam being forested while the other soils are invariably cleared. Nearly all the forest land has been cut over. The growth consists of white oak, red oak, chestnut oak, tulip poplar, ironwood, maple, shagbark hickory, basswood, chestnut, black locust, redbud, and ash.

About 40 per cent of this type is cleared and is mainly in permanent pasture, only small patches being devoted to corn, oats, wheat, timothy, and clover. Corn yields 15 to 45 bushels per acre, the higher yields being received upon the red areas, in which the soil has been influenced by thin limestone strata. Wheat is usually grown upon the patches of Upshur soil and yields 10 to 20 bushels per acre. Timothy hay ranges in yield from one-half to  $1\frac{1}{2}$  tons per acre. Much of the type is too steep for the use of the mowing machine, and hay production is confined to the benches or flat ridge tops. This is essentially a grazing soil. Bluegrass sod holds well on the Upshur areas, and is exceptionally strong where the soil is in part from limestone. In some sections, noticeably around Elk Creek in the vicinity of Overfield and Peeltree, large numbers of cattle are grazed. The pasture will maintain a steer to the acre. Large numbers of cattle are kept per acre in some places, but they are not sustained entirely on grass. Owing to the location of this type near the hilltops very few homesteads are located upon it, and consequently little garden truck or fruit is grown.

The selling value of land composed of the Meigs clay loam ranges between rather wide limits, with the location and topographic position. The ordinary price lies between \$25 and \$40 an acre, but in many cases it is as much as \$100.

The means suggested for improving the Upshur silty clay loam, Dekalb silty clay loam, and Westmoreland silty clay loam, respectively, can be applied where these soils dominate over areas of the Meigs clay loam. The present general use of this land for grazing is probably the best to which it can be put. Erosion is active and it is consequently best to maintain as heavy a sod as possible. The stand should be rejuvenated or the land reseeded before erosion denudes the steep hillsides of their soil covering. Where new land is

cleared or sod land is reseeded the slopes should not remain exposed any longer than necessary. Where the rejuvenation of old sods is necessary the use of lime, bone meal, and Thomas slag has been found beneficial. Thin beds of limestone outcrop on the hillsides below this type in most of the area, and the matter of transportation does not stand in the way of the use of lime. Phosphatic fertilizers have been found advantageous in growing grain and grass crops in other counties of this State where this soil occurs.

#### WESTMORELAND SILTY CLAY LOAM.

The Westmoreland silty clay loam consists of a brown to yellowish-brown silt loam to silty clay which passes quickly into a brown or yellowish-brown silty clay loam, underlain at 8 to 10 inches by yellow to yellowish-brown, heavy silty clay loam to moderately stiff clay. The soil material is largely derived from gray and yellow shale, and resembles the Dekalb silty clay in its physical features, but a number of thin limestone strata also occur in the formation and material derived therefrom makes this type more productive than on Dekalb soils. Some of the shale beds from which the type is derived are also more or less calcareous.

In patches along the outcrop of the limestones, grayish to brownish-yellow, heavy clay loam soils are found, underlain by stiff, plastic, yellow to olive-drab clay, with small boulders and fragments of limestone scattered upon the surface. These patches represent the Brooke clay loam as mapped in other West Virginia areas. Patches of Upshur clay and silty clay loam, too small and irregular to map, are also encountered over the type.

The Westmoreland silty clay loam is developed in the western part of Barbour County, north and west of a line drawn through Peeltree, Century, Elk City, and Berryburg. It usually occupies fairly steep hillsides, but erosion is less active than on most soils having similar topography.

Nearly all of the type is cleared and in permanent pasture. There are a few cultivated fields on each farm, devoted chiefly to corn, wheat, oats, and timothy and clover, but owing to its comparatively unfavorable location and steep topography the type is used almost entirely for grazing, and as a grazing soil it is properly held in high esteem. It supports a heavy bluegrass sod and is capable of maintaining more cattle, sheep, or horses per acre than any other upland soil in the area. Where it is forested the growth consists chiefly of oak, with a scattering of hickory, ash, chestnut, ironwood, maple, walnut, and locust. There are more walnut trees than upon any other type in the area.

Yields on this soil are good. Corn yields 25 to 45 bushels per acre, wheat 15 to 25 bushels, oats 25 to 35 bushels, and hay  $1\frac{1}{2}$  to  $2\frac{1}{2}$  tons.

Comparatively few farmsteads are located on this soil and the orchard and garden development is naturally small. Fruit trees, especially apple, seem to be in a thriving condition, and judging from the few gardens seen vegetables do exceptionally well.

Land of the Westmoreland silty clay loam is valued very highly from an agricultural standpoint, being held for about \$100 an acre.

As sod lasts well upon this soil there is little need for rejuvenating sod land except in patches where the influence of the limestone or calcareous shale is weak. Phosphatic fertilizers, lime, or manure would improve the sod where it is thin. Leguminous crops are valuable on this soil. Such crops as clover, vetch, cowpeas, melilotus, soy beans, and alfalfa are suited to it and should prove profitable adjuncts to the hay crop as well as soil improvers. This land is prized highly for grazing. The more nearly level areas and bench positions can be profitably cultivated.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Westmoreland silty clay loam:

*Mechanical analyses of Westmoreland silty clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
221915.....	Soil.....	1.3	2.1	0.6	2.1	4.4	58.2	31.0
221916.....	Subsoil.....	.6	1.7	.7	2.2	2.4	50.9	41.3

#### HOLSTON SILT LOAM.

The Holston silt loam is a light-brown, mellow silt loam 6 or 8 inches deep, overlying yellowish silt loam which passes in a few inches into yellow silty clay loam or silty clay subsoil, somewhat compact but friable when dry.

This type occupies stream terraces or second bottoms lying well above overflow and representing the former flood plain of the stream. The material is washed largely from the Dekalb soils in some cases, and in others, judging from the soils in the drainage basin of the streams along which it is developed, partly from areas of Upshur soil.

The Holston silt loam is not very extensive. The largest areas occur near Buckhannon and Belington. A few smaller areas are scattered along the larger streams, and some small areas are found on low divides between stream heads. The most noticeable of these are at Frenchton, between the headwaters of French Creek and Fall Run, at Atlas between the head of Brushy Fork and Fall Run, and near Berryburg between the head of Foxgrape Run and Simpson Creek. The surface of the type is nearly level, with a few



eroded drainage ways extending from the outer edge into the body of the soil and affording good surface drainage. The original deposits have in places been disturbed by erosion.

Much of this soil is occupied by towns and farm buildings, owing to its even topography in an otherwise hilly country, to its good drainage, and to its elevation above floods. Practically all the other areas are cleared and under cultivation. The few trees left standing show the sturdiness of the original tree growth. These are largely oak, beech, chestnut, poplar, and sycamore. Beech probably predominated, as these areas were spoken of in the early settlement of the country as "beech flats." The individual holdings on this type are usually small.

Corn is the principal crop. Vegetables are grown in many gardens. Wheat, oats, buckwheat, clover, timothy, and cowpeas are produced on a small scale.

The yields obtained vary between wide limits, according to the cultural methods used, the fertilizers, and the previous handling. Some areas are properly farmed, while others are rented and become run down, making the yields very low. Corn yields 25 to 65 bushels per acre, hay  $\frac{1}{2}$  ton to 2 tons, Irish potatoes 100 to 300 bushels, and buckwheat 20 to 25 bushels. Cowpeas and soy beans give good yields.

Attempts to improve this soil consist in turning under sod where hay land has failed or plowing under cowpea or clover stubble and applying lime at the rate of 500 to 1,000 pounds per acre. Bone meal or acid phosphate is applied preceding the sowing of wheat, at the rate of 250 to 300 pounds per acre. Probably more fertilizer is used on this than upon any other soil in the area. On many farms, however, little effort has been made to maintain the productiveness of the soil and yields have steadily declined. The type is topographically better suited to cultivation than most of the other soils, and improved machinery can be used to advantage. There are many silos on this soil, but as very little of the land is in pasture comparatively few cattle are kept. There are, however, many hogs on these terrace-land farms.

The price of land of the Holston silt loam type varies between wide limits. Improved farms and some of the small holdings near towns or prospective towns or industrial sites are held at relatively high prices, ranging from \$100 to \$200 or more an acre in some cases. The ordinary farm land brings from \$50 to \$100 an acre.

Where this soil has deteriorated the incorporation of organic matter would materially increase its productiveness. The growing of cowpeas, clover, soy beans, and vetch would be beneficial, even if only the stubble is turned under. Rye and buckwheat are also valuable crops for increasing the organic content. The supply of manure available under the present system of farming is only suf-



ficient to treat small, intensively cultivated fields and gardens. The use of 1,000 to 2,000 pounds of burnt lime per acre about every five years, would prove beneficial, and applications of bone meal or acid phosphate, at the rate of 250 to 500 pounds per acre, before sowing small grain or grass would undoubtedly result in increased yields. About 600 pounds per acre of a good complete fertilizer could profitably be used upon potatoes and other vegetables.

The Holston silt loam is a very good Irish-potato soil, and is used extensively in the commercial production of this crop in other parts of the State. Where the facilities for shipping exist there would seem to be no obstacle in the way of a similar use in this area. Other truck crops could also be produced where the market conditions warrant. Alfalfa is grown with fair success on several farms on this soil. In other parts of the State alfalfa has succeeded on the Holston silt loam where it has been brought to a high state of cultivation. Liming is necessary and inoculation essential to success. Bright Burley tobacco of excellent grade has been grown successfully on this soil in the southwestern part of the State.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Holston silt loam:

*Mechanical analyses of Holston silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
221901.....	Soil.....	0.3	1.0	1.2	12.7	11.8	58.2	14.8
221902.....	Subsoil.....	.1	.5	.9	10.8	9.4	61.4	17.0

MOSHANNON SILT LOAM.

The typical Moshannon silt loam is a reddish-brown, mellow silt loam, 8 to 10 inches deep, grading into a subsoil of reddish-brown silty clay loam or silty clay, only slightly compact and friable. Beds of gravel, consisting mainly of sandstone fragments, are often encountered within the 3-foot section. Near stream channels the soil grades to a loam and often immediately along the bank to a fine sandy loam. In places the lower subsoil is a plastic clay mottled with yellow and reddish colors. In very wet places the soil also may be lighter colored or mottled. Some included areas have a surface soil of silty clay loam texture.

The Moshannon silt loam is developed principally along Hackers Creek and the head of the Right Fork of Stone Coal Creek. It occupies first-bottom, overflow land along streams that receive their wash from drainage basins in which there is a considerable area of Upshur soils. The type occurs on almost level bottoms lying

from 3 to 15 feet above stream level. Some of it lies above normal overflow and is subject to only occasional floods. Drainage is well established. As on most bottom land, the overflows are of decided advantage, as they leave a deposit of rich soil material.

Practically all this type is cleared and either in cultivation or used as hay or permanent pasture land. The remaining trees indicate that the forest growth was heavy and consisted largely of sycamore, elm, beech, birch, and willow. The greater part of the cultivated area is in corn, the yield of which equals that of the best soils of the corn belt. A small acreage is devoted to sorghum for sirup. Timothy and millet are the principal hay crops. Oats, wheat, and buckwheat are of little importance. Irish potatoes are planted on the higher lying portions of the bottoms, and are a relatively important crop.

Considerable numbers of beef cattle are kept on this soil, being grazed, fed from haystacks, and from silos filled with corn from the bottom land. Most of the land in grass is mowed twice a season, besides being grazed, the hay stacks being fenced round with rails to keep the stock from them until grazing time is past. The permanent pastures furnish good grazing even during the driest years. Besides the cattle some horses, sheep, and hogs are raised on this type.

Corn does better than any other crop; the yield ranging from 40 to 80 bushels per acre, with an average of about 50 bushels. Oats and wheat give heavy yields, but both have a tendency to lodge and are not generally grown. Timothy cuts 1 to 2½ tons per acre. Where a second cutting is made the yield is usually light, but the quality of the hay is good. When the hay crop is short millet is sown as a substitute, and gives good yields.

Fertilizer, manure, or lime is not commonly used on the Moshannon silt loam, except on the areas that lie above normal overflow. No definite crop rotation is followed, and changes from corn to hay or vice versa are rare. The soil is easily handled and forms a mellow seed bed with little cultivation.

The Moshannon silt loam is one of the most valuable farm soils in the area, its selling price ranging from \$75 to \$200 an acre. The type enhances the value of farms in which it is included with other soils.

This soil is handled under good farming methods. The low, wet, or swale areas should be drained by ditches or tiles. The abundance of weeds in the hay shows that the grass lands are allowed to stand too long without reseeding. Best results are obtained where the land is reseeded after the second year. In the higher lying areas the soil could be improved in the manner suggested for the Holston silt loam.

## MOSHANNON SILTY CLAY LOAM.

The surface soil of the Moshannon silty clay loam is a brown to reddish-brown, mellow silt loam which passes within a few inches into a slightly compact silty clay loam of the same range in color. The subsoil is a brownish-red to reddish-brown silty clay loam to silty clay, compact but friable rather than plastic. In places the deep subsoil is a mottled yellow or reddish, plastic clay. In depressions, usually representing old stream channels, the soil is lighter colored or mottled and really represents Atkins silty clay loam. Such areas were not mapped separately, because of their small size.

The Moshannon silty clay loam lies in the first bottoms of streams that receive their wash largely from the Upshur silty clay loam and where the valleys are comparatively shallow and the streams rather sluggish. It is developed in the northwestern part of Upshur County, the largest areas being those along Fink Run.

This type is not quite so productive for general farm crops as the silt loam, owing to its somewhat poorer drainage and to the difficulty in cultivation, resulting from the comparative shallowness of the soil and the heavy nature of the subsoil. Practically all the type is cleared. A large proportion of the land is in pasture and much of the rest is used for hay production. The tilled crops occupy a very small acreage, and of this corn probably takes half. The forest growth is practically the same as that upon the silt loam, except that there is more beech and sycamore.

This soil seems to be best suited to grass, the hay yields ranging from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  tons per acre. Timothy is the leading grass sown for hay, but redtop is employed to some extent. Wild grass is cut in the low situations. Corn yields 30 to 60 bushels per acre. In many places the cornfields are spotted with areas of poor stand, which represent patches where the surface is poorly drained or where the soil is heavy and has been puddled by plowing when too wet. Wheat, oats, rye, clover, cowpeas, and potatoes are grown on small areas, and give fairly good yields, but the soil does not seem so well adapted to these crops as to corn or grass.

Considerable numbers of cattle, horses, and hogs are kept on this soil. Cattle are pastured in large numbers during the spring and summer and grazed upon the hay lands after the hay is cut and stacked. Only about 1 acre of this soil is required to support a steer.

This soil contains low areas in need of drainage. There is little necessity of fertilizing or manuring, as the annual inundations leave a deposit of rich material that furnishes an abundance of plant food. Care must be taken not to plow or cultivate this soil when wet, as under such conditions its physical properties are easily impaired.

## POPE SANDY LOAM.

The Pope sandy loam consists of a light-brown sandy loam underlain at 6 to 10 inches by yellowish-brown, slightly compact, friable sandy loam. In many places beds of gravel are encountered within the 3-foot section, consisting mainly of sandstone. In some places, notably near the banks of the larger streams, the sand content is relatively high, the material often constituting almost pure beds of stream-washed sand. There are some included areas of sandy loam.

This type occurs as first-bottom, overflow land along streams which flow from areas where the Dekalb stony loam, Dekalb sandy loam, and Rough stony land predominate. It is mapped in the southern and eastern part of Upshur County and along streams in Barbour County that head in Laurel Ridge.

The type in many places lies well above normal overflow, the channels of the streams being broad enough to carry the water at times of ordinary rises, so that the type is inundated only during excessive floods. This is not the case along all the streams, but is the condition commonly existing along the larger ones. Three to twenty feet represents the range of elevation of the bottoms above the streams.

The surface of the Pope sandy loam is fairly level, with slight swells running in the direction of the streams. Drainage is well established owing to the porous nature of the soil, subsoil, and substratum. Most of the type is cleared, but some of it still remains in the native forest of sycamore, poplar, beech, birch, and some pine, with an undergrowth of laurel and rhododendron.

Corn occupies probably one-half to two-thirds of the cultivated area. Little effort is made to grow other grains. A relatively small area is in hay or permanent pasture as compared with other bottom-land soils, and such crops as sorghum, cowpeas, millet, and sweet potatoes are grown more extensively than upon other bottom lands. Irish potatoes and other vegetables grown in gardens succeed well. Owing to the poor quality of the pastures few cattle are kept on this soil, but probably more hogs are raised than on the average farm. Corn yields 20 to 45 bushels per acre. Hay usually yields less than 1 ton per acre. The hay crop is usually composed of mixed timothy, red-top, and native grasses. Very little clover is grown.

Agriculture is not as highly developed on this soil as on the other bottom-land types. Little fertilizer is used and no manure or lime. Practically no attempt is made to increase the productiveness by turning under grass sod or cover crops, and most of the fields are deficient in organic matter. As the inundations are rather irregular they can not be depended upon to keep up the fertility. The soil is easily tilled, requiring only light draft, and little improved machinery is in use.



Land of the Pope sandy loam is priced ordinarily at \$20 to \$50 an acre, but there are a few individual farms held at a higher price.

The deficiency of organic matter should be corrected by turning under grass sod or such crops as cowpeas, vetch, and rye, which are well suited to the type. Where manure can not be supplied fertilizer should be used rather liberally. The soil is adapted to sorghum, sweet potatoes, melons, and light truck crops. Trucking could be developed as a profitable adjunct to general farming where markets and shipping facilities are accessible.

#### POPE SILT LOAM.

The Pope silt loam is a light-brown or grayish-brown to brown, mellow silt loam, underlain at 6 to 8 inches by yellowish-brown silty clay loam which quickly passes into yellow or pale-yellow silty clay. The lower subsoil of some included areas is mottled with gray and is somewhat plastic, but in general the subsoil is friable. Some patches of Pope silty clay loam, differing in having a heavier and more compact soil, are included with the silt loam.

The Pope silt loam is developed in overflowed first-bottom areas, lying along streams which drain regions in which silty clay loam of the Dekalb series dominates. It occurs in the central part of the area, its largest development being in the broad bottoms of the Buckhannon River below Buckhannon. Along the smaller streams the type lies about 2 to 5 feet above stream level and is subject to frequent overflow. It contains numerous patches of low, poorly drained areas which really represent Atkins silty clay loam. Along the larger streams, including the Buckhannon and Tygart Rivers, it lies 20 to 25 feet above stream level and is subject to only occasional overflow. Here the low, poorly drained areas occur in sufficient size to be mapped separately.

The Pope silt loam is the most extensive bottom-land soil mapped. The existing tree growth indicates that the original forest consisted of oak, beech, maple, sycamore, elm, poplar, and willow. Nearly all of this has been cleared away, and the land extensively used for corn and hay and as pasture land. Many cattle are raised. Wheat, buckwheat, oats, and cowpeas are minor crops. Corn yields 30 to 60 bushels per acre. Timothy yields 1 to 2½ tons of hay per acre and redtop slightly higher.

No systematic rotation is followed on this soil. Fields are planted to one crop for indefinite periods. Little or no fertilizer, manure, or lime is used.

The type can be improved by the means suggested for the Moshannon silt loam. Drainage of the lower bottoms is very essential for the successful production of crops. While these bottoms make fairly good pasture and grass land in their native condition, underdrainage must be resorted to before complete success with tilled crops may be ex-



pected. This soil, while naturally less strong than the Moshannon, will produce good crops if properly handled. Corn and hay are best suited to the soil and should be given preference over other crops.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Pope silt loam:

*Mechanical analyses of Pope silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
221927.....	Soil.....	0.3	0.4	0.4	15.0	16.9	47.7	19.2
221928.....	Subsoil.....	.0	.2	.7	12.8	18.0	41.6	26.5

#### HUNTINGTON SILT LOAM.

The Huntington silt loam is a light-brown to brown, mellow silt loam passing at 10 to 12 inches into a brown to yellowish-brown silt loam, which usually becomes slightly heavier and more compact in the deep subsoil, which in places is a silty clay loam. In spots along the smaller streams beds of gravel, consisting of fragments of shale and sandstone, are encountered within the 3-foot soil section.

The Huntington silt loam is a first-bottom soil subject to overflow. It occurs along streams that receive their wash mainly from the Westmoreland silty clay loam, and like that soil, is influenced by wash from soils derived from the thin strata of limestone that outcrop on the hillsides. This gives rise to a soil slightly stronger than the Pope silt loam, which is derived from the wash from sandstone and shale areas. Drainage is good over nearly all the type, as is shown by the absence of mottling in the subsoil.

The Huntington silt loam occurs in stream bottoms in the western part of Barbour County. Practically all of it is cleared and under cultivation. The original forest, which at one time was heavy, consisted of sycamore, beech, elm, maple, and poplar.

About half the type is in corn, the remainder being used as hay or permanent-pasture land and to a small extent for several minor crops. Grain is not grown extensively, as it has a tendency to produce too much straw. Corn gives the best yields of any crop, producing 40 to 80 bushels per acre without the use of fertilizers. Timothy cuts  $1\frac{1}{2}$  to 2 tons of hay per acre. The pastures have good sod which holds even during dry seasons. Many cattle are grazed upon the pastures and hay lands. Nearly all the vegetables grown in this section are produced in the gardens on this type. Irish potatoes do exceptionally well on the higher lying areas.

This soil, like the Moshannon silt loam, does not need fertilizer, lime, or manure, as the annual inundations leave a rich deposit of

soil material. The same methods of improvement are needed as for the Moshannon silt loam.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Huntington silt loam:

*Mechanical analyses of Huntington silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
221921.....	Soil.....	0.1	0.2	0.1	6.5	15.0	53.8	24.1
221922.....	Subsoil.....	.1	.2	.2	13.9	20.2	42.4	22.9

ATKINS SILTY CLAY LOAM.

The Atkins silty clay loam consists of a grayish-brown or mottled grayish-brown and gray silty clay loam, underlain at 6 to 10 inches by a bluish-gray silty clay loam, mottled with yellowish brown or rusty brown, and usually having a plastic structure in the lower subsoil. In places the soil is light brown and the upper subsoil is yellowish, but gray mottling quickly appears below. In included areas, usually lagoons or oxbow bends of abandoned stream channels, the surface soil is much darker, ranging to almost black where the organic content is high.

The Atkins silty clay loam occupies poorly drained first-bottom overflow positions. It usually lies 2 to 4 feet above stream level. The type occurs in nearly all parts of the area, and is derived from nearly all the soils. Its principal developments are in the "meadows" in the northwestern part of Upshur County and in the glade land of the eastern part of Barbour County.

This type occurs under two conditions, as ordinary bottom land along streams that have reached temporary base level, and around the heads of streams where it is supported by sandstone strata. In the latter position, found scattered over the northeast part of Barbour County, the surface is level or gently sloping toward the streams. In the former position swales occur next to the hills and constitute the lowest part of the bottom, while a strip along the stream is fairly well drained.

The Atkins silty clay loam is known locally as "crawfish land." Its naturally poor drainage has been corrected in several instances by underdraining with tile. Nearly all of the type is cleared and either cultivated or used as hay or pasture land. The type originally was covered by a heavy forest growth similar to that on the other bottom-land soils, and the uncleared areas at the present time support a growth of willow, alder, and baybush.

Probably one-third to one-half the type is in permanent pasture. This is not very often reseeded, and consists of native wild grasses, "glade grass" predominating. This grass is found in mowings also. Bulrush is abundant in the low spots where water stands. Some corn is grown, but when there is too much rainfall the yield is low, and corn fields are inclined to be spotted with poor stands. Where the soil is properly drained good yields of corn, hay, oats, and cowpeas are obtained. Corn yields 20 to 60 bushels per acre and oats 20 to 30 bushels. Oats are grown only in the better drained areas. Timothy hay cuts 1 to 2½ tons per acre, but heavier yields of inferior hay are often obtained. Grasses furnish good, succulent pasture even in dry seasons.

Very little fertilizer or manure is applied on this soil, and lime is not used to any appreciable extent. Various means are employed to improve the drainage. In a few places the fields have been plowed into "lands" varying from 10 to 20 feet wide, with the dead furrow running with the slope. Open ditches serve in some instances to carry off the surplus water. The general fall of the streams is sufficient to insure good drainage, as is shown where the channels have been straightened or other systems installed.

This soil is not valued as highly from the standpoint of crop production as the other heavy bottom-land soils, but owing to its favorable position some of it is held for a higher price than its true agricultural value would warrant. It is valued at \$40 to \$100 an acre.

In improving the Atkins silty clay loam the drainage is the first and most important factor to be considered. This soil must be drained by artificial means before any great success with crops can be expected. After thorough drainage, lime can probably be used to good advantage. It should be applied at the rate of probably not less than 1 ton of burnt lime per acre. The supply of organic matter over parts of the type is sufficient, but over much of it, especially where the surface soil is light gray in color, the organic content is low. Organic matter can be supplied by applying stable manure, by turning under grass sod, or by growing and plowing in green-manure crops. This soil is not naturally adapted to clover, but alsike clover might prove successful in the better drained areas. Cowpeas can be successfully grown where the soil is properly drained.

In a series of experiments carried on in Preston County, soil similar to this type has proved highly productive of such truck crops as cabbage, cauliflower, kale, onions, lettuce, tomatoes, beans, and squash. The soil here was thoroughly drained and treated with a complete fertilizer. This soil can not be recommended for early truck crops, on account of its heavy, cold nature, but heavy yields of late vegetables may be expected. Complete fertilizers probably should be used on vegetables at rates of 300 to 600 pounds per acre.

Little advantage will be gained, however, from applying fertilizer on the undrained soil. Land of this type should not be plowed or cultivated when too wet, as it has a tendency to clod and puddle, becoming hard when dry.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Atkins silty clay loam:

*Mechanical analyses of Atkins silty clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
221917.....	Soil.....	0.2	0.6	1.0	6.9	7.4	62.0	22.1
221918.....	Subsoil.....	.0	.5	1.0	6.2	8.8	61.1	22.2

#### ROUGH STONY LAND.

Rough stony land, as mapped in Upshur and Barbour Counties, includes all the land so steep and rocky as to be of very little or of no agricultural value. There are, however, some included patches that are cultivated or used for grazing. These included areas, as well as the interstitial material in the more stony areas, are largely Dekalb loam or sandy loam.

Rough stony land is most prominently developed along the gorge or valley walls of the Tygart River from Arden to the Taylor County line and extending up Sandy Creek almost to Hiram, on the Tygart River from Philippi to Belington, extending up the Middle Fork of the Tygart River to the Randolph County line; and along the Buckhannon River from Nixon to Beans Mill and around the headwaters of the Little Kanawha River. Possibly the largest development of this type, which differs widely from the other areas, is that along the western slope of Laurel Ridge throughout its entire length.

Rough stony land is derived largely from the Pottsville conglomerates, and it occurs fairly consistently along and immediately below the horizon of the outcrop of this rock. The rock is hard and resistant, and the original outcrop can be traced usually by the bold cliff rock or huge blocks or boulders strewn upon the surface. The slopes below for many hundred feet are usually strewn with smaller boulders and fragments brought down by gravity.

Most of the land was originally heavily forested, but much of the merchantable timber has been removed by lumbermen. The dominant tree growth on the mountain sides and along the river gorges is spruce and pine, with an undergrowth of laurel and rhododendron, but most of the land is covered with chestnut, chestnut oak, oak, and a scattering of other hardwood trees.

This land can be used for grazing to a limited extent, but the pasturage is poor and it is difficult for animals to subsist upon it.

The type is probably best left in forest.

#### SUMMARY.

Barbour and Upshur Counties are situated in the north-central part of West Virginia, and comprise a total area of 699 square miles or 447,369 acres.

The area lies in the greatly dissected portion of the Appalachian Plateau, and the topography in general is steep and broken, though somewhat modified over the northwestern part. Laurel Ridge, in the eastern part of Barbour County, is the most prominent topographic feature. The elevation above sea level ranges from 1,000 to 1,800 feet in the northwestern part of the area to 2,000 to 3,000 feet along the eastern border, with a maximum elevation of 3,250 feet on Laurel Ridge.

The greater part of the area is drained by the Tygart River and its principal tributaries, Buckhannon River and Middle Fork. Part of southwestern Upshur County drains into the headwaters of the Little Kanawha River, and the western part of Barbour County is drained by small streams into the West Fork of the Monongahela River. The two counties had a total population of 32,487 in 1910. The northwest corner of Upshur County is the most thickly populated section. Most of the inhabitants of both counties are engaged in farming, but lumbering and coal mining are important industries. Buckhannon, and Belington are the largest towns.

The area is fairly well supplied with railroad facilities, and the public roads are fairly good, considering the difficult topography.

The local towns and coal-mining camps furnish good local markets for farm products. Grafton, Clarksburg, and Fairmount are near-by markets. Baltimore and Pittsburgh are the principal outside markets for cattle and sheep.

The climate of the area is temperate and healthful and well suited to general farming and stock raising. The mean temperature for the winter as recorded at Philippi is 32.25° and for the summer 70.35° F. The mean annual precipitation of 47.86 inches is well distributed throughout the year, and is ample during the growing season. The average growing season is about five months.

The agriculture of the Barbour and Upshur Counties area consists mainly of general farming and stock raising. The principal crops grown are hay, corn, wheat, buckwheat, and oats. There is a large acreage in permanent bluegrass pasture and a relatively large acreage of hay land.



The average size of the farms is about 93 acres. About 90 per cent of the farms are operated by owners. The value of all property per farm is \$3,573 for Barbour County and \$2,895 for Upshur County.

Barbour and Upshur Counties lie wholly within the Appalachian Mountain and Plateau Province. The upland soils are derived from the weathering in place of alternate strata of sandstone, gray and red shale, and thin beds of limestone of the Carboniferous era. They are classed in the Dekalb, Upshur, Meigs, and Westmoreland series. The alluvial soils along the streams are derived from sediments washed from the uplands. The Holston series is recognized on the terrace or second bottom, and the Moshannon, Pope, Huntington, and Atkins series in the first bottom or flood plain.

The soils of the Dekalb series have yellowish-brown surface soils and yellow to yellowish-brown subsoils. The Dekalb silty clay loam is the second most extensive soil mapped in the area. It is well suited to pasture and is extensively used for that purpose. The more level areas are suited to general farm crops and to fruit. The loam and silt loam occur on the caps of hills and ridges, and have a somewhat level topography. They are better suited to cultivation and are used for general farm crops, buckwheat occupying the largest acreage. The Dekalb stony loam is the most extensive soil in the area, and is extensively developed over the southern and eastern part of the area, where it occupies steep hillsides. It is not so well suited to pasture as the silty clay loam, but is used to some extent for that purpose. The stony sandy loam is of small extent, and is used very little for agriculture, being mainly in forest.

The Upshur silty clay loam has a reddish-brown to red surface soil and a red subsoil. It is widely distributed over the northwestern part of the area. It is the strongest upland soil type, and is well suited to hay, corn, wheat, and oats. Much of it is in permanent bluegrass pasture, for which it is well suited.

The Meigs clay loam represents areas of undifferentiated Upshur and Dekalb material. It occupies the summits of hills and extends well down their steep sides. It is used mainly for pasture. On account of its elevation and inaccessibility much of it is in forest.

The Westmoreland series is practically the same as the Dekalb except that it is influenced by limestone. The Westmoreland silty clay loam occurs upon the hillsides in the western part of Barbour County. It makes excellent grazing land, being covered with a heavy bluegrass sod.

The Holston silt loam is the only terrace soil mapped. Its largest developments occur at and around Buckhannon. Much of the type is occupied by towns and buildings and the farms are small. The

type is used for general farm crops and vegetables. It has a fairly level topography and lies well above overflow.

The recent-alluvial or first-bottom soils are classed in the Moshannon, Pope, Huntington, and Atkins series.

The Moshannon series has brown to reddish-brown soils and reddish-brown to red subsoils. The silt loam of this series is encountered mainly along the streams that flow west into Lewis County. It is used mainly for corn and hay. The silty clay loam is found along streams in the northwest part of Upshur County. It occurs in lower, broader bottoms than the silt loam and is used for corn, hay, and pasture.

The Pope soils are more extensive than the Moshannon. They are found over the southern and eastern parts of the area and along the larger streams. This series has brown to yellowish soils and yellow to yellowish-brown subsoils. The silt loam is derived from the wash from heavy upland soils. It is used for corn, oats, hay, and pasture. The sandy loam is derived from sandier and stonier soils. It is used to some extent for the same crops, but is not as productive as the silt loam.

The Atkins silty clay loam has gray to grayish-brown, mottled soils, with mottled gray, yellow, and drab, plastic subsoils. It is found in the bottoms in the northwestern part of Upshur County and in the glades in the eastern part of Barbour County. It is poorly drained in its natural state and is used chiefly for hay and pasture.

The Huntington silt loam has a brown or chocolate-brown soil and a brown or yellowish-brown subsoil. It occurs along streams that receive their wash largely from the Westmoreland soils, and is developed in the western part of Barbour County. It is a strong soil and is used for corn, hay, and pasture.

Rough, stony land comprises steep, stony areas, covered almost entirely with forest. It is of little or no agricultural value.



[PUBLIC RESOLUTION--No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture "

*Resolved by the Senate and House of Representatives of the United States of America in Congress assembled*, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the Congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



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